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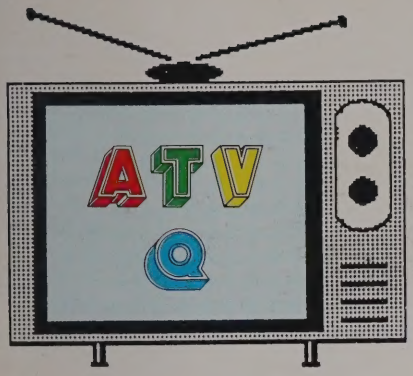

AMATEUR TELEVISION QUARTERLY

APRIL 1989

VOL. 2 #2
ISSN: 1042-198X
USPS 003-353

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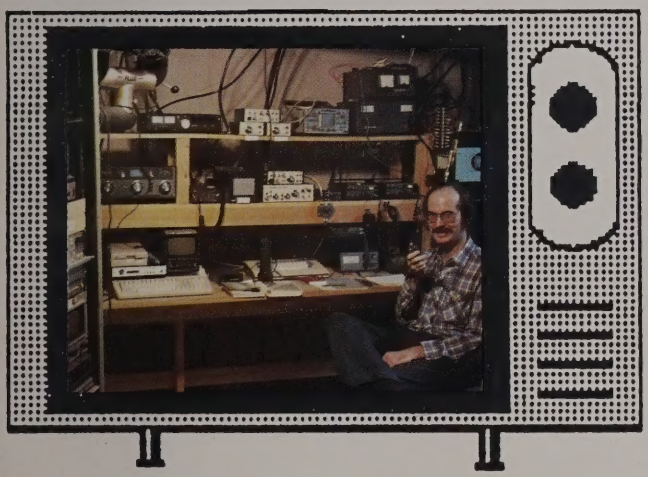

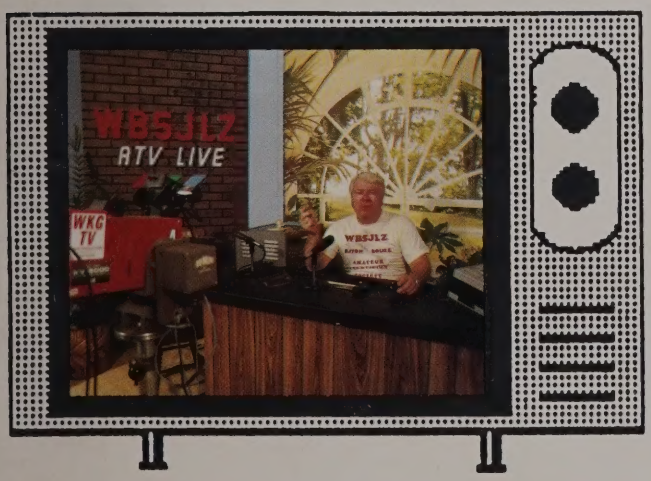

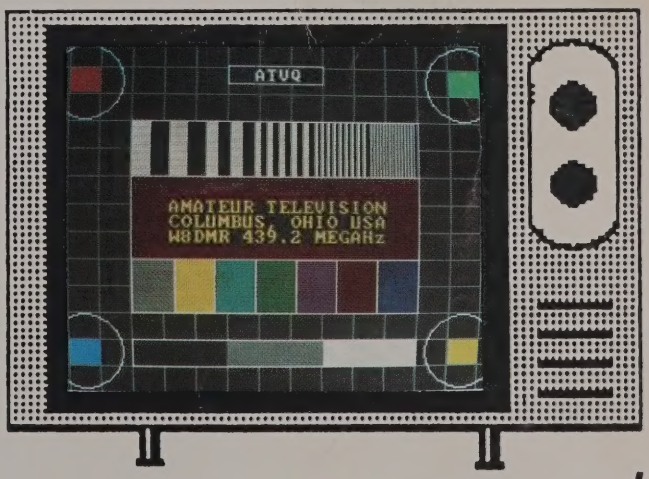

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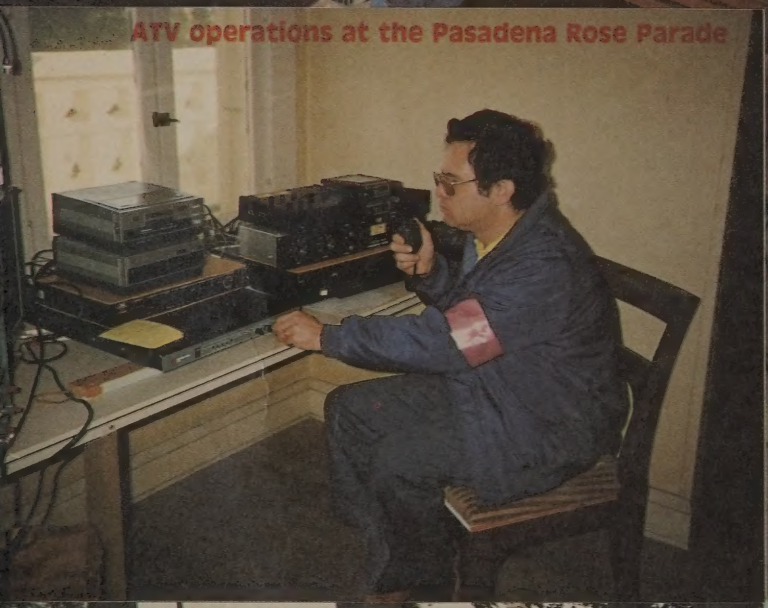

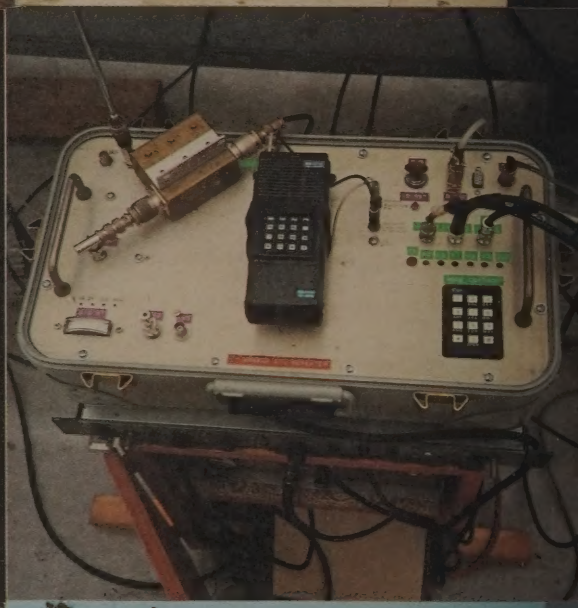

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★ Tuesday, January 3, 1989

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—Delmer Beckhart, tournament official

Story on Page 11

Ham Operators: Parade's Communications Lifeline

By AMY PYLE, *Times Staff Writer*

APRIL 1989 **AMATEUR TELEVISION QUARTERLY MAGAZINE** **VOLUME 2 #2**
ISSN # 1042-198X USPS # 003-353 92 PACKED PAGES!!

Amateur Television Quarterly Magazine is published four times a year by Henry R. Ruh KB9FO at 540 E. Oakton St., Des Plaines, Illinois 60018-1950. Annual subscription rate for domestic delivery is $15 per year. Canadian delivery is $20 per year in US Funds sent first class mail. Delivery to other countries is $25 per year US funds and sent as air-mail, printed matter. Second Class Postage paid Des Plaines, Illinois and additional offices of entry. Second Class Mail Permit Number USPS 003-353. POSTMASTER: Send change of address to: Amateur Television Quarterly Magazine, 1545 LEE ST. SUITE 73, Des Plaines, Illinois 60018. All inquiries, subscriptions and submittal should be sent to: Amateur Television Quarterly Magazine, 1545 Lee St. Suite 73, Des Plains, Illinois 60018. The logo and trademark of Amateur Television Quarterly Magazine is ATVQ as displayed on our front cover. The Business phone number is 312-298-2269. Note that the phone company will be changing the area code in January 1990. Co-publisher is Bill Brown WB8ELK. Technical Editor is Tom O'Hara W60RG. Editor is Sylvia Kurcz. Typist and word processing by Laurie Woisniewski. Editorial offices are located at 540 E. Oakton St., Des Plaines, IL 60018-1950. However, because of curb side delivery it is preferred that all mail be addressed to 1545 Lee St. Suite 73, Des Plaines, IL 60018.

FRONT COVER PHOTOS: TOP LEFT - WB5JLZ ATV SHACK, TOP RIGHT - PHIL WB6LQP AT ROSE PARADE CONTROL HQ, BOTTOM LEFT - WB8ELK IN THE KB9FO ATV SHACK, BOTTOM RIGHT - ATV ID FROM BILL W8DMR. INSIDE FRONT COVER AND INSIDE BACK COVER: ROSE PARADE ATV STATIONS - STORY ON PAGE 11.

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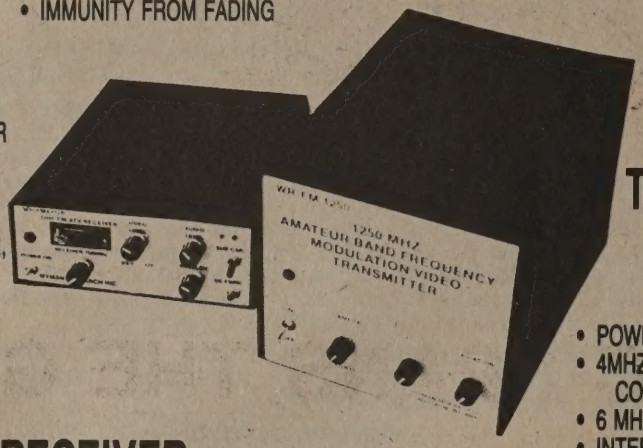

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VIC-20/C-64 ATV CONTROLLER

LYN H. CYR, W1NRE

Prior to the advent of the inexpensive home computer, the design of repeater control circuits had to be carefully thought out and allowances made for future developments and expansions. Once the hardware circuit design had been frozen it could have been frustrating to implement revisions.

Many microprocessor control circuits appeared in magazines and on the market which simplified the design of repeater control functions. Most of the features, however, were designed for voice grade repeaters and while very versatile they left a void for the ATV repeater task. What was needed for a viable ATV controller was the generation of video graphics and ease of programmability without resorting to machine languages, eproms, as well as not breaking the bank.

The following ATV controller uses a Commodore VIC-20 or C-64. The computers, as supplied, have an addressable 8-bit I/O port and two "el-cheapo" analog to digital converters in the form of paddle inputs. They also have the ability to keep track of real time which can be used to advantage.

Our first attempts used a VIC-20 as an ATV controller but was later changed to a C-64 because of the VIC's relatively poor performance at time keeping. I am told there are ways to improve it, but the C-64 was chosen because of its greater memory and graphics capabilities. If time keeping is not vital to your operation the VIC-20 will perform nicely. The following discussion is orientated to the C-64 but the material applies equally as well to the VIC. The basic differences will be screen size, for graphics, and the memory locations for the I/O port usage as well as reduced memory space. The C-64 used in the W1NRE ATV repeater has been developed to provide a 32-bit I/O port, a 16 channel 8-bit A/D converter, and touch tone decoder. Also contemplated and in progress is a spectrum, analyzer function using a defunct VHF-UHF varactor tuner. Upon touch-tone command or prior to a transmitter key-up, a spectrum "snapshot" would be taken to be displayed through the repeater. The applications are endless.

Recognizing that machine language routines are much faster, the program was written in Basic nonetheless. As a controller, it operates at more than adequate speeds.

Enough chit-chat. Let's get to the heart of the matter at hand. The key to using the C-64 as a controller depends on the ability to communicate with the I/O port. On the back of the C-64 is a user port connector to which the outputs of a memory mapped 6526 CIA (Complex Interface Adapter) chip is connected. The 6526 is indeed a complex interface adapter chip and it is not the intention to discuss all of its features and functions. Refer to the "Commodore 64 Programmer's Reference Guide" for further discussions on this chip. For our purposes, only the 8-bit I/O lines will be discussed. The lines of interest are PB0 through PB7. These lines form an 8-bit parallel word which can be programmed as either input or output lines. Communicating through these lines is done by a couple of memory locations.

There are two registers, each with its own address, which controls the flow of data. The first register is a Data Direction Register (DDR). This register dictates which of the eight lines will be used as inputs and which will be used as outputs. Once the directions have been established, the data flows in and out of the data bus through another register known as the Data Register located at a separate address. Prior to using the Data Registers, the DDR has to be initialized or told which direction data will flow. If a bit in the DDR is a "1", the corresponding line of the port will be an output. If a bit is set to "0" then the corresponding line will become an input. In Commodore basic, issuing a POKE command allows you to write to memory while a PEEK instruction lets you read a memory location. The general format is <POKE(address),-value> to enter data into a location and <PEEK(address)> to read the data at the location. The address is in the decimal memory location and the value is also in decimal having a range of 0 - 255. The chart on the next page summarizes the I/O lines, their pin numbers, the decimal weights and their bit positions. The address of the DDR on the C-64 is 56579 and 37138 for the VIC, while the Data Registers are located at 56577 and 37136 for the C-64 and VIC respectively. Suppose we wanted our I/O port configured so that liens PB0 and PB1 act as outputs and PB2 through PB7 as input lines. The first order of business, early in the program instructions, would be to inform the DDR of that fact. We would issue the instruction POKE (56579),3. The decimal value of 3 would make bits PB0 and PB1 logical "1" instructing the I/O port to have them become output lines. The remainder of the lines would be inputs. This simple instruction is referred to as initializing the I/O port and must be done prior to using the port. Once initialized, data can be transferred through the I/O port at location 56577. If we wished to make PB1 a logic "1" the instruction POKE (56577),2 would suffice. PB0 would be at logic "0", PB1 at logic "1" and PB2 through PB7 would take on the states of the external signals. If we wanted to know the state of all the lines a PEEK (56577) would read the status of the I/O port. If all the inputs were at logic "1" and PB1 were logic "1" and PB0 logic "0", reading the port would give a decimal value of 254. Peeking a location, however, does not give us the value to work with. It has to be stored in some variable.

For example:

```
10 PEEK(56577): Rem** Read the port
20 C=PEEK(56577): Rem** Read the port and store it as C.
```

Step 20 does both at the same time. Now you can make decisions

	I/O PORT (USER PORT)/O PORT							
BIT/LINE NUMBER	PB7	PB6	PB5	PB4	PB3	PB2	PB1	PB0
DECIMAL VALUE	128	64	32	16	8	4	2	1
PIN NUMBER	L	K	J	H	F	E	D	C
logic level	1	0	1	0	1	0	1	0

based on the value of C. In the example given, if line 20 were executed, C would have a value of 254.

One more trick before looking at a simple COR/Transmit routine. When reading the port, it is often desirable to determine the status of only one bit. The AND instruction is one method to achieve this. One way of looking at the AND instruction is as a binary multiplication. That is 1 X 1 =1, 1 X 0 =0 etc. For instance, assume that the port had a decimal value of 170. This would mean that PB7(128), PB5(32), PB3(8) and PB1(2) would all be at logic "1" and the remaining lines would be logic "0" (see chart above).

The decimal value comes from: 1x128+0x64+1x32+0x16+1x8+0x4+1x2+0x1=170

If we had PEEKed this information, a decimal value of 170 would have been returned. It would be a bit cumbersome to determine if line PB6 were high or low. By using the AND instruction a precise determination can be made very quickly. If 64 were ANDed with 170 it would effectively multiply every bit by zero except PB6 which would have been multiplied by 1. Remember that a "1" at PB6 has a decimal value of 64. Regardless of the status of the other bits, the bit products would have been zero and the value of PB6 would have been preserved because it got multiplied by 1. So if a value of 64 had been returned as a result of Peeking the I/O port the value of PB6 must have been at logic "1" because 1x1=1 and 1x64=64. If on the other hand a value of zero would have been returned, PB6 had to be at logic "0" because 0x1=0 and 0x64=0. The instruction to do this is C=PEEK(56577)AND64. If C=64 then PB6 is high and if C=0 then PB6 is sitting low. These I/O instructions allow to control anything from stepping motors to ATV controllers.

A few notes about the I/O port. The PB0-PB7 lines have passive as well as active pull-ups providing both CMOS and TTL compatibility. The port has a 2 TTL load drive (32ma) capability making it easy to interface. If load requirements exceed these limits use transistor drivers or digital buffers. Being of the "old school", I still like to hear relays click as shown in the interface circuit of Figure 1. Relays also provide a high degree of isolation between the computer and the outside world. In designing your interface circuits, keep in mind that when the computer is first turned on, all of the bits on the port are sitting in a high state and once you program the bits to become outputs they switch to a low state. This can be handled by using inverting buffers on all output lines, or using a switch to defeat the interface circuit while booting up the computer via a local/repeat switch.

The interface circuit was built on a Radio Shack experimenter's PC board (276-154) to which a 12/24 pin edge card connector was soldered to the fingers of the board. The 12/24-pin connectors might be hard to come by but you can cut a 22/44-pin connector to fit the I/O Port. For the User Port, the pin spacing is .156 inches. A PC mounted terminal block was used to interconnect the transmitter keying line and COR. Video connections were made using BNC jacks or you could use RCA phono jacks. I have included LEDs which are helpful in debugging the software or simply letting you know the status of the port.

The schematic is simple enough and doesn't warrant too much explanation except for the drive transistors. The transistors can be any PNP type which will handle the current requirements of the relays. In this configuration, the transistors provide the needed logic inversion thus preventing external circuits from being energized at computer turn on. It does, however, pose an aggravation in the software since a "0" must be poked to turn on a function. See Figure 1 for circuit details.

A short program with its logic flow is provided in Table I. The program is functional as an ATV repeater but meant to illustrate the principles discussed. I am sure you would want to develop the program beyond this. The program as described will provide a beacon mode, key a transmitter with key-up and drop-out delays and select one of two video sources. The IDs and graphics are left to your imagination.

Program description:

Line 10: Initialize PB0PB1 as outputs, PB3 through PB7 inputs.

Line 20: Make sure outputs are turned off (remember the logic is inverted)

Line 100: Input the time HHMMSS format)

Line 120: Convert time (TI$) into a numerical value. TI$ is a clock which starts from 000000 at turn on and increments every second. It can be programmed to start from a specific count.

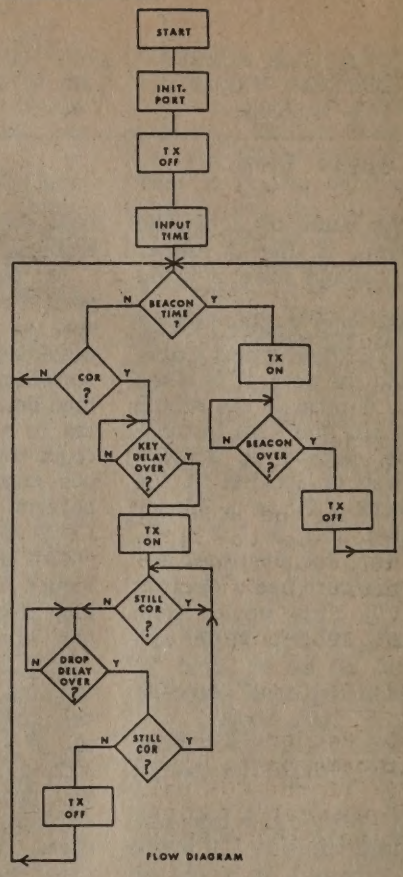
Line 130:Check for times to beacon. Any number of time slots can be entered. If it's time to beacon then go to line 4000, if not go to next line.

Line 140:Read status of COR bit

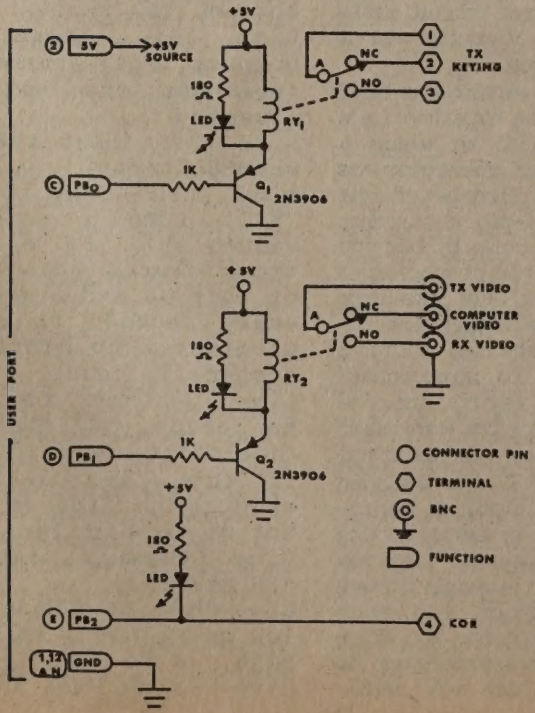
Line 150: If COR line is low go to 1000, if COR is high, go to next line.

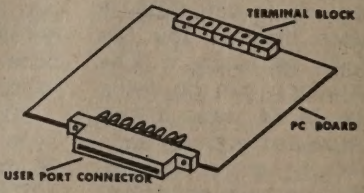
Line 160: Go back and wait

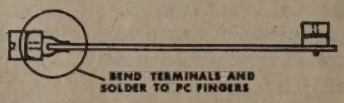
```
1 REM  ********************************
2 REM  *  BASIC COR/TRANSMIT ROUTINE  *
3 REM  *        L.H.CYR, WINRE        *
4 REM  ********************************
5 REM
10 POKE(56579),3
20 POKE(56577),3
60 REM
100 INPUT"□↓↓↓↓↓↓↓↓↓↓       ENTER THE TIME (HHMMSS)";TI$
105 PRINT"□"
111 PRINT"↓↓↓↓↓↓↓      WAITING FOR COR OR BEACON TIME"
115 REM
120 T=VAL(TI$)
130 IF T=170000 OR T=173000 GOTO4000
140 C=PEEK(56577) AND4
150 IF C=0 GOTO 1000
160 GOTO115
1000 REM KEYING ROUTINE
1001 PRINT"□↓↓↓↓↓↓↓↓↓       KEY-UP DELAY"
1002 FORX=1TO600:NEXTX
1010 C=PEEK(56577)AND4
1020 IF C=0 THEN2000
1025 PRINT"□"
1030 GOTO111
1040 REM
2000 POKE(56577),2
2001 PRINT"□↓↓↓↓↓↓↓↓↓       TRANSMITTER IS ON"
2002 PRINT"       AND RX VIDEO HAS BEEN SELETED"
3000 C=PEEK(56577)AND4
3010 IF C=0 THEN3000
3015 PRINT"□↓↓↓↓↓↓↓↓↓       DROP-OUT DELAY"
3020 FORX=1TO600:NEXTX
3030 C=PEEK(56577)AND4
3040 IF C=0 THEN 2001
3050 POKE(56577),3
3055 PRINT"□"
3060 GOTO111
4000 REM BEACON MODE
4010 PRINT"□"
4015 POKE(56577),0
4020 PRINT"□↓↓↓↓↓↓↓↓↓   INSERT BEACON GRAPHICS HERE"
4030 FOR X=1TO 1000:NEXTX
4040 POKE(56577),3
4045 PRINT"□"
4050 GOTO111
```

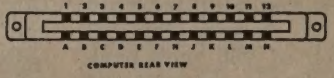


FLOW DIAGRAM









PIN	
1,12,A,N	GROUND
2	5 VDC
C	PB 0
D	PB 1
E	PB 2
F	PB 3
H	PB 4
J	PB 5
K	PB 6
L	PB 7

FIGURE 1. SCHEMATIC AND BOARD DETAILS

for beacon time or COR>
Line 1000: Start of keying routine.
Line 1002: Provides a delay before going on. Experiment with value of x to suit your delay times.
Line 1010: Recheck COR to see if it is still there. If it is, go to line 2000. If it is not, go back and wait for beacon or COR>
Line 2000: Key up transmitter and select received video.
Line 3000: Check COR again.
Line 3010: If the COR is still active go to 3000 and keep transmitting. If COR is absent go to drop-out delay.
Line 3015: Drop-out delay routine
Line 3020: Drop-out delay time
Line 3030: Recheck COR to see if it came back.
Line 3040: If the COR was still present keep transmitting, otherwise go to the next line.
Line 3050: Unkey transmitter and unselect video source.
Line 3060: Go back and wait for beacon time or COR.
Line 4000:Start of beacon routine.
Line 4015: Key transmitter and select beacon video.
Line 4030: Wait before going on. Transmit time of beacon mode.
Line 4040: Unkey transmitter
Line 4050: Go back and wait for next beacon time or COR.

After you have built the interface card turn the computer off and plug it in the User Port. Load the program as shown and press run. You will be prompted to enter the time. As programmed, the beacon time is 17:00:00 and 17:30-:00 hours. Enter 165955. The display will show you that it is waiting for the beacon time or COR. After 5 seconds, the screen will display the fact that it is in the beacon mode. After a short time the program will return to the wait state. If you ground the COR line, the screen will display the key-up delay and then show you when the transmitter is keyed. Removing the ground from the COR input, the screen will show you the drop-out delay after which it will return to the wait state. A COR at beacon time will present it from going to the beacon routine. As shown, the program is such that once the beacon routine has started it cannot be interrupted. If you wish to interrupt the beacon, PEEK the I/O port and make a decision based on the value of C.

The program at the W1NRE ATV repeater is a bit more involved but they are all further extensions of the basic routines described. Many text to speech modules are available and the Simon Basic cartridge should not be overlooked for high resolution graphics.

Attempts have not been made to burn the program in an Eprom but there are a number of products available that will allow you to make an auto-boot basic program cartridge. The other alternative is to battery back up your system.

Blow the dust off your unused Commodore and enhance your ATV repeater functions or use the techniques to automate your shack. Even if purchased new, the C-64c is still a cost effective way of getting a repeater controller which can be tailored to your needs.

If interest warrants it, signal reporting with bar graph routines, using the paddle ports as A/D converter can be discussed. Happy controlling.

THE ROSE PARADE HAM TV VIDEO TAPE

Now available is a limited quantity (only 100 copies were made and 20 were donated to the participants) of video tapes made at the Pasadena Rose Parade. The tape contains the following: Open logo, "please pirate" notice and introduction by Henry KB9FO. Followed by about 20 minutes of behind the scenes video shot at the Wrigley Mansion showing the TV feed control and beginning of the Satellite TV feed. Followed by the 2 hours sent via satellite, followed by 2 hours more of the ATV public service effort to the parades conclusion. In total over 4 1/2 hours.

The masters were shot on S-VHS and VHS HQ and 3/4" U-matic. These were dubbed to 1" C broadcast format and assemble edited on C. Then the 1" completed master was dubbed to 6 hr mode (SLP/EP) VHS using a $250,000 Ikegami mastering machine used to make master reference tapes for VHS alignment. The accuracy of these tapes is 1 micron! The video quality from the VHS master making machine is higher than any 2 HR mode industrial or home VHS machine! The masters were FIRST GENERATION as recorded at the Wrigley mansion directly from the OFF-AIR ATV receiver used to relay the signals to the "end users" and the satellite feed and were processed using a frame synchronizer and color corrector as well as professional Tektronix waveform/vector scopes to get the best possible image from the 16 live ATV feeds all along the parade route. In short, you couldn't get a better tape if you were there doing it yourself. The few video wiggles were from the live feeds as received at parade HQ.

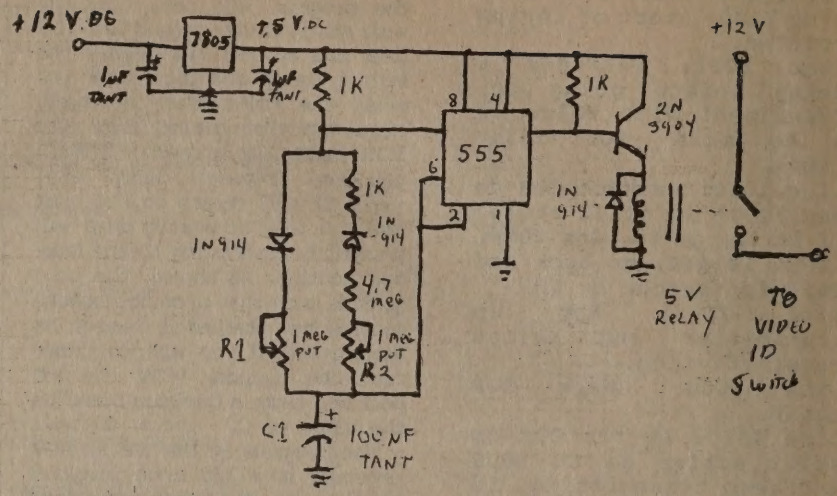
Henry KB9FO pre-paid to have the tapes edited and duplicated. We are offering them at cost, which includes the dubbing, editing, tape stock, vinyl case with labels, shipping box and shipping costs. We are doing this so that other groups can have a "showcase" program of ATV public service.

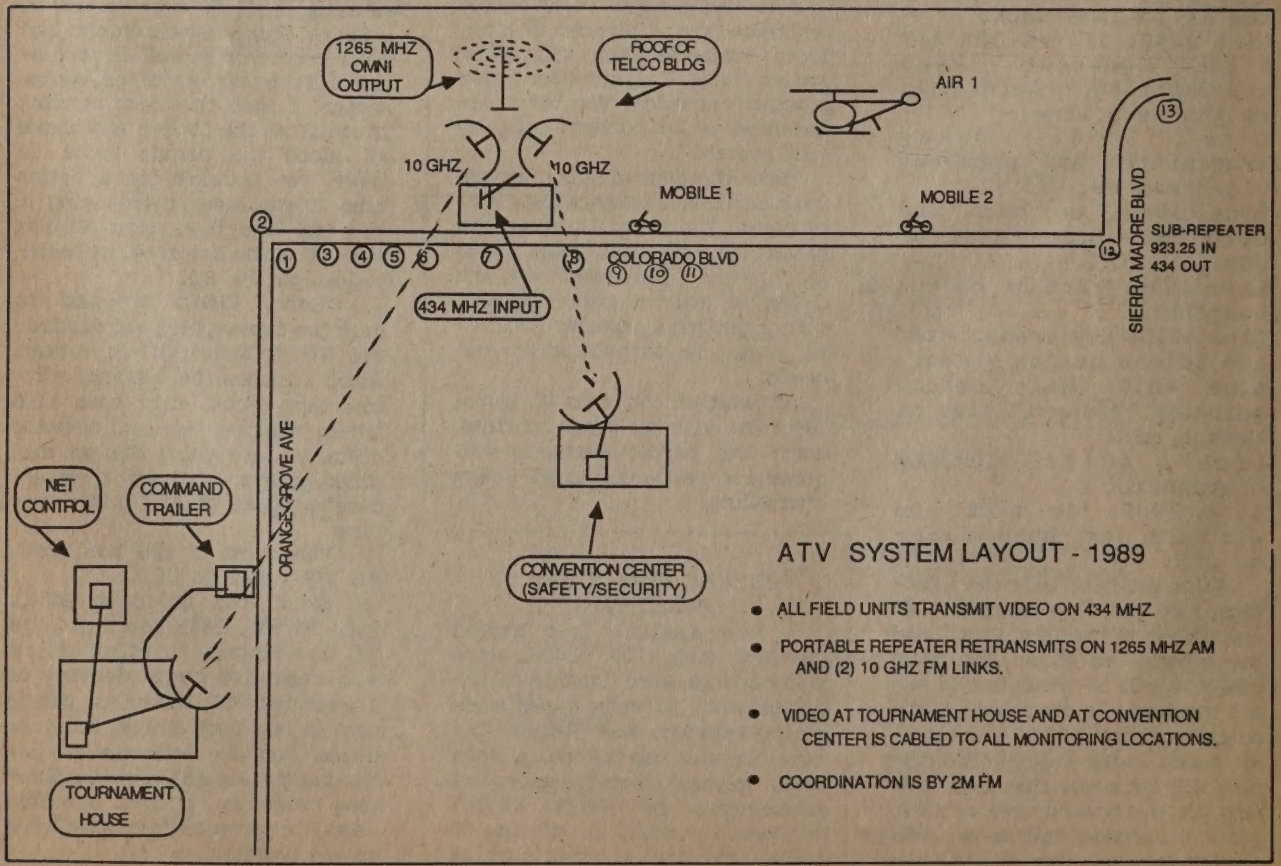
Your cost is $20 post paid. NO VISA, M/C or COD.

Send your order to ATVQ, Rose Parade, 1545 Lee St., Suite 73, Des Plaines, IL 60018. Allow two weeks for postal delivery or 1 week for UPS. If surface parcel post is not fast enough for your needs, you are welcome to pay the freight for air delivery. Shipping weight is 2 pounds. FOB Chicago. This program is not available from any other source.

VIDEO I.D. TIMER

When showing long video tapes or retransmitting Space Shuttle flights a need for an automatic video identifier becomes necessary. During the last shuttle mission I used this circuit to turn on and off the VDG-1 video I.D. board. Every 10 minutes the computer I.D. would automatically come on for 10 seconds. The only problem occurred during the landing. Just as the shuttle was about to touch-down my I.D. came up!! I haven't heard the last of that one yet. The value of R1 determines the Relay On-time and R2 determines the Off-time. Also by changing the value of C1 different time delays can be obtained. For example by changing C1 to 33uF I was able to set up the balloon experiment for 30 seconds of computer I.D. and 2.5 minutes of live camera. Use of a tantalum capacitor for C1 is recommended for best accuracy.




1265 MHZ OMNI OUTPUT
ROOF OF TELCO BLDG
AIR 1
10 GHZ
10 GHZ
MOBILE 1
MOBILE 2
SUB-REPEATER 923.25 IN 434 OUT
SIERRA MADRE BLVD
COLORADO BLVD
434 MHZ INPUT
ORANGE GROVE AVE
NET CONTROL
COMMAND TRAILER
TOURNAMENT HOUSE
CONVENTION CENTER (SAFETY/SECURITY)
ATV SYSTEM LAYOUT - 1989
ALL FIELD UNITS TRANSMIT VIDEO ON 434 MHZ.
PORTABLE REPEATER RETRANSMITS ON 1265 MHZ AM AND (2) 10 GHZ FM LINKS.
VIDEO AT TOURNAMENT HOUSE AND AT CONVENTION CENTER IS CABLED TO ALL MONITORING LOCATIONS.
COORDINATION IS BY 2M FM

ROSE PARADE ATV COVERAGE UPLINKED VIA SATELLITE

Bill WB8ELK

An ATV first occurred during the 100th Rose Parade on Jan. 2, 1989. ATV'ers across North America were able to watch the coverage of the parade by the Amateur Television Network (ATN) group of Southern California. Thanks to the efforts of Dave Steinfeld, WA6ZVE, a satellite uplink was provided on Galaxy 2, transponder 5 for two hours of live coverage. The parade lasts about 5 hours from srtart until the last float gets to the end of the route. Michael Landon started the activities rolling with an entertaining introduction to ATV. Phil, WB6LQP described the Amateur Television Network and some of the past events it has covered. Ernie, WB6BAP then showed us his portable ATV repeater and some of the equipment necessary to follow the parade along its route. The extensive network of portable and mobile ATV stations along the 6 mile long parade provided detailed coverage of any emergency or float breakdown to allow parade officials, police and medical personnel an immediate television view of the problem. Thirteen portable ATV stations on 434 Mhz were situated at intersections along the route as well as two Motorcycle Mobile ATV'ers (Mobile 1 and 2) and even a helicopter piloted by Tom, W6ORG providing spectacular aerial shots of the parade. The heart of the system was the portable repeater on the roof of the six-story telephone company building. The repeater received the signals from the remote camera positions and relayed them to the emergency services area and the Wrigley Mansion (Rose Parade Control Center) via microwave links on the 10Ghz and 1.2 Ghz bands. Ernie, WB6BAP used a small beam on the roof of the telephone company building to provide additional receive gain when needed for distant stations and the helicopter. Occasional glimpses of Ernie and the repeater could be seen during the satellite uplink. Due to intervening buildings a sub-repeater. (923.25Mhz in - 434 out) was located at Camera 12 to relay Camera 13 at the extreme end of the parade. Hank, WB6MEU was located in the Wrigley Mansion controlling the video levels for satellite uplink. He was assisted by Henry KB9FO. He also routed the signal down to the Control Center where Phil, WB6LQP coordinated all the remote camera video on two meters. A FORTEL video processor was used to ensure a good quality video signal for the uplink. From the Wrigley Mansion the processed video was sent via optical cable phone lines and microwave links to the satellite uplink site. The satellite downlink was monitored at the Control Center by Dave, WA6ZVE using the portable TVRO system in his RV. The downlink was also received directly by hundreds of ATV'ers across the country. The Mt. Diablo ATV repeater near San Francisco and the Metrovision repeater near Washington D.C. relayed the downlink so their members could watch the action.

The ATN group of Southern California covers many such events throughout the year which demonstrate the incredible public service capabilities of ATV. Thanks to all those in the ATN group for showing me the setup (although I could use a new pair of shoes after walking the entire parade route!). Special thanks to Louise Candage, our dedicated ATVQ photographer who obtained the photos in this issue even after being lassoed by Monty Montana and nearly being eaten alive by a Chinese Dragon!

NET CONTROL:
Phil, WB6LQP
REPEATER OPERATIONS:
Ernie, WB6BAP Hugo, KA6CGD
SATELLITE UPLINK Monitor:
Hank, WB6MEU, Henry, KB9FO
MEDIA MONITOR:
Dave, WA6ZVE, Gary, N6LIE
INTERLINK MONITOR:
Don, N6IXP
SAFETY MONITOR:
Jim, N6JXI
AMATEUR COMM. COORDINATOR:
Fred WB6OJK
HELICOPTER Mobile (AIR 1):
Tom, W6ORG Rick, N6UEM
MOBILE 1:
John, KB6MMF Bud KB6MID
MOBILE 2:
Jim, N5COT
CAMERA 1:
Bob, N6AZV, Dave, WA6PMX
CAMERA 2:
Jim, N6PFP, Jan, WB6VRN
CAMERA 3:
Ed, N6KCB, Bill, KA6TCL
CAMERA 4:
Allen, KA6WGO, Rick, KA6DAN
CAMERA 5:
Warner, N6HNR, Gordon, N6RGS
CAMERA 6:
Joel, KB6RXE, Larry, N6QZI, Patty Ruple.
CAMERA 7:
Hugh, K6TLJ, John, W6QMB, Jean Kraus.
CAMERA 8:
Jim, K6KOM, Jeff, KB6GSA
CAMERA 9:
James, KB6WUM, Sean, KB6WUK
CAMERA 10:
Bob, W6LUY, Mark, N6KES
CAMERA 11:
Wes, WA6IPN Mark, KJ6H
CAMERA 12:
Gary, WB6VVV, Doyalene, WB6FLG, Jerry, KB6AQD, Mike, WA6SVT
CAMERA 13:
Rod, WB9KMO, Koichi, KB6EL Mike, WA6ILQ

VIDEO REPEATER AND LINK SYSTEM FOR ANNAPOLIS MARYLAND

BOB BRUNINGA, WB4APR

Several Washington DC area individuals pioneered the development of amateur video transmission in the US and have operated the Metrovision ATV repeater for more than 15 years. Similarly, the Baltimore Radio and Television Society (BRATS) has installed an ATV repeater and is very active in the Baltimore area.

An excellent repeater location exists on top of the Naval Academy water tower which provides excellent coverage of the local area and links to the existing ATV systems in Washington DC and Baltimore as shown below. A three phase plan has been proposed to allow incremental operating capability as construction proceeds.

PHASE I, RECEIVER LINK:

This phase installs a remote receiver on top of the water tower to relay both METROVISION and BRATS ATV signals at 426 MHz onto 923 MHz to the Annapolis area.

PHASE II, LINK TRANSMIT CAPABILITY:

This phase adds a 1296 MHz transmitter at the water tower repeater site to link Annapolis originated ATV signals into the METROVISION and BRATS repeaters in Washington DC and Baltimore:

COMPUTER CONTROL PORTS:

The VIC-20 Computer is used both as the character/ID generator as well as the controller and scheduler for the system. It will use touch tone controls for operator input and has a packet input for SYSOP control functions. The character generator will display the call sign of the repeater, its location and also the operating mode and status to users. The computer operates from a battery back-up uninterruptable supply and most characteristics and timing functions are adjustable by the control operator over the packet link. The I/O port assignments are as follows:

INPUTS	PORT
T/T ACCESS ENABLED	JOY0
T/T SELECT CAMERA	JOY1
T/T SELECT MODE	JOY2
REC CYNC DETECTED	FIRE
PACKET SERIAL	CB1/CB2

OUTPUT	PORT
SW RX TO BEAM	PB0
SW RX BEAM TO BALT	PB1
SW RX FREQ	PB2
923 XMT ON	PB3
1296 XMIT ON W/923	PB4
SW TX BEAM TO BALT	PB5
SWITCH IN CAMERA	PB6
AVAIL	PB7

SCREENS AND FUNCTIONS:

PRIMARY IDENTIFICATION SCREEN

On for 20 sec after each access
Display Call Sign,
Display Present Repeater MODE
Display Camera Status

SECONDARY IDENTIFICATION SCREEN

On for next 10 sec
Lists Trustee Info
Lists Supporting Clubs
PR Information of Interest

TEST PATTERN AND COLOR BAR SCREEN

Alternates w/screen 1

ANNOUNCEMENTS AND SCHEDULE

Alternates w/screen 2

SYSOP PARAMETERS

During SYSOP packet access

PHASE III, REMOTE CAMERA:

This phase adds a remote control camera on top of the water tower to provide views of the two River Bridges, and principal streets in town to support public service events. The camera can be rotated through about 300 degrees in azimuth and will present video while the repeater is not receiving any uplink video. The camera will be remote controllable using touch-tone control signals over a two meter link.

REPEATER/LINK CONTROL SYSTEM:

The majority of the repeater system is under the control of the VIC-20 computer which also provides the character generator and graphics for video identification and status reporting to the control operator. The user control mechanism will be touch-tone over a two meter simplex frequency. The repeater will operate in a number of modes as follows:

OP MODE	IN	RCV ANT
LOCAL rpt	439	quasi omni
METRO rpt	426	beam to DC
	439	selectable
BRATS rpt	426	beam to Balt
	439	omni
CROSSLINK	426	beam to Wash
	426	beam to Balt
	439	selectable

OP MODE	OUT	ANT	LINK
LOCAL rpt	923	omni	
METRO rpt	923	omni	
	923	omni	1296 beam to DC
BRATS rpt	923	omni	
	923	omni	1296 to Balt.
CROSSLINK	923	omni	1296 to Balt
	923	omni	1296 to DC
	923	omni	1296 select

TOUCHTONE CAMERA CONTROLS:

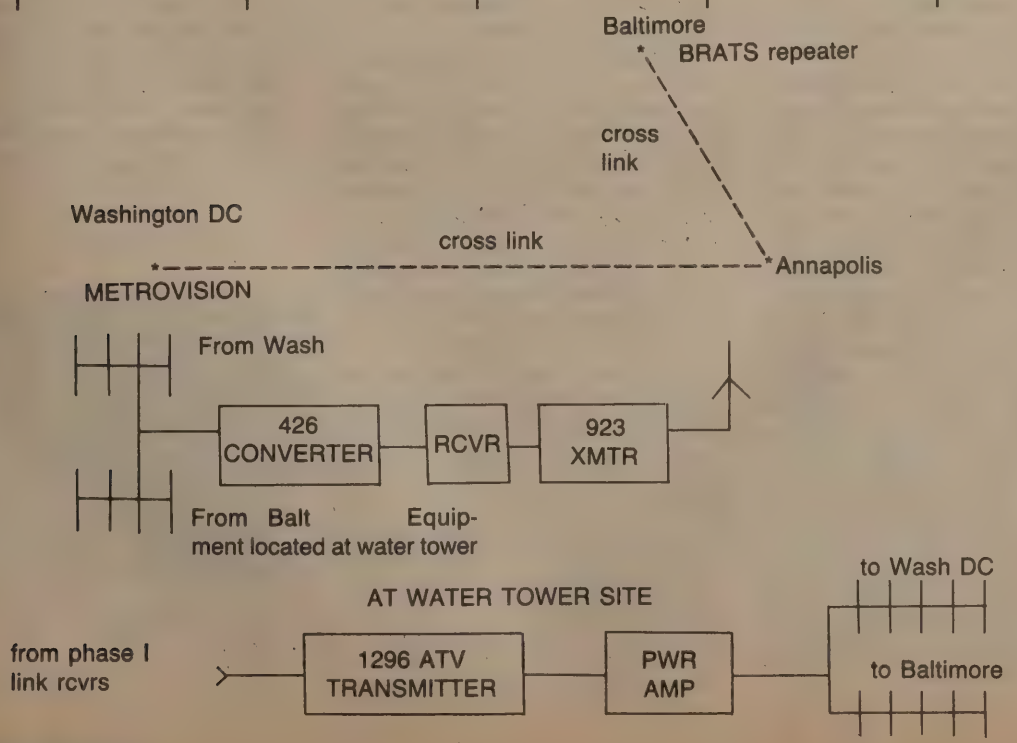
Focus, aperture, zoom, left/right, up/down

DTMF PAD

1 LEFT	2 UP	3 RIGHT	A FOCUS
4 ZOOM IN	5 DOWN	6 ZOOM OUT	B FOCUS
7 SEL MODE	8 SEL CAMERA	9 RSVD	C CLOSE
* ACCESS	0	# OFF	D OPEN

MODE CONTROL ALGORITHM DEFINITIONS:

Rcvr State	STANDBY MODE	LOCAL MODE	METRO MODE	BRATS MODE	CROSS LINK
STBY	omni rcv 1sec Fscan permanent	omni rcv 439 rcv T/O 10 min	M rcv 10 s 1sec Fscan T/O 30 min	B rcv 10 s 1sec Fscan T/O 30 min	omni rcv 1sec Fscan permanent
SYNC RCVD	stop Fscan xmit 923 if 426 then A scan & stop	stop Fscan xmit 923	stop Fscan xmit 923 if 426 then A scan & stop if 439 then xmt 1296 M	stop Fscan xmit 923 if 426 then A scan & stop if 439 then xmt 1296 B	stop Fscan xmit 923 if 426 then A scan & stop if M, xmt B if B, xmt M
LOSS of SYNC	hold 923 30 show ID scan immed	hold 923 30 show ID scan immed	hold 923 30 show ID hold 1296 2 then scan	hold 923 30 show ID hold 1296 2 then scan	hold 923 30 show ID hold 1296 1 then scan
CAMERA	hold ID 2 then camera for 5 min on 923	hold ID 2 then camera for 5 min on 923	hold ID 2 then camera for 5 min on 923 1296 for 1	hold ID 2 then camera for 5 min on 923 1296 for 1	hold ID 2 then camera for 5 min on 923 1296 for 1



ATV OPERATING NEWS

Response to our last issue was overwhelming. The issue had a circulation of 3400 and in less than two weeks after its release we received over 450 additional subscribers and stores were reporting SOLD OUT. We received several hundred well wishes from readers which are much appreciated.

We would like to thank all the clubs, individuals and advertisers who sent us their rosters, local ATV op lists and mailing lists that made it possible. With all the kind support and help we received the circulation of this issue is even bigger which has allowed us to run the full color pages and expand the issue. Using proportional printing has allowed us to fit what would have taken over 100 pages into this 68 page issue.

Since the last issue ATVQ has traveled around the country and received a lot of mail from readers. The extra copies held at our office for late subscribers went quickly.

ATVQ staffers visited several areas of the US to meet with ATVers and participated in the Pasadena Rose Parade. There is a complete story about that later in this issue.

The week of Nov 20th to 26th found Henry and Sylvia travelling to central Florida. Along the way using a 120 watt ATV transmitter and a 20 element H/V circular polarized beam antenna working ATV'ers in Indiana, Kentucky, Ohio, Georgia and Florida. Best mobile DX was 70-75 miles to fixed stations in Ohio. This was while moving down I 75. We were able to get an eye of the storm report on Hurricane Keith which came ashore at Treasure Island, FL where we stayed the night! Video tape of that shows flooding, trees downed and our car rocking in the wind even though it was parked in the shelter of the 2nd floor deck. Seen from the "safety" of our room on the third floor which was flooded to 1" made for some exciting times at 1 AM as I tried to figure out what I would do if the patio door glass broke in the wind! The wind was blowing the door jamb more than an inch apart which let the wind and rain in. Soon the floor was covered in water and we were on the leeward side of the hotel! The next morning debris filled the beach and pool on the Gulf side of the hotel. Two days later we were in Daytona Beach chatting with the ATVers there and getting ham shack shots of Bob W3EFG and Vic W3LGV. We met Vic's new YL, June N4DWF. They were married only two weeks before we arrived. They met via ham TV.

We are happy to report that their repeater is doing well and the FM interference problems are being worked out now that the DBARA is handling central Florida 450 Mhz FC.

Bill WB8ELK took off cross country in his ATV mobile with stops in St. Louis, Kansas City, Wichita, Tucson, and So. Cal. plus points between. Bill reports about his excursion a little later. Bill and Henry met again when Henry flew out to LA to pitch in with the 50 ATVers involved in the Pasadena Rose Parade.

Bill went to Las Vegas for the CES show the following week while Henry flew back to Chicago. Bill reports on goodies soon to be available in the market place which should be of interest to ATVers later this issue.

Bill is continuing up the California coast and will return to the midwest through the southwestern states.

ATVQ HAMFESTS

ATVQ will be in booth 361 at Dayton so look for Henry, Sylvia and Bill. Henry has plans completed to leave Dayton saturday night to fly to England to be at the BATC convention which is on Sunday coincident with Dayton. Look for a first hand report about the BATC and hamfest "jet lag" in the next issue.

DAYTON ATV FORUM

1445-1700 ROOM 3 SATURDAY

Topics: 70 cm full duplex or repeat with 33,23 cm Tom W6ORG;

ATV from a 7lb 100" long high power rocket Bob Rau N8IYD;

250 watt ATV TX for 3.5 Ghz for under $200, Dave Pacholok KA9BYL.

ORLANDO will also have an ATVQ booth with Henry in attendence. Henry will also be a speaker at the ATV forum at Orlando Hamcation.

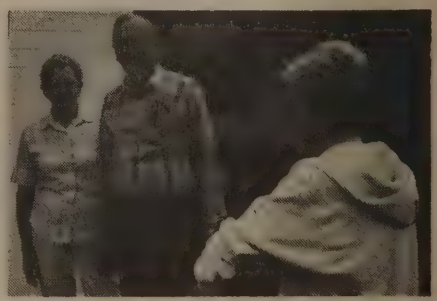
ARRL NATIONAL CONVENTION
ARLINGTON, TEXAS

June 2-4 will have ATVQ technical editor Tom O'Hara W6ORG manning the ATVQ booth.

The "crazy ATV'ers" at ATVQ will travel almost anywhere to report on ATV activity. To invite us to your ATV/hamfest just drop us a line with the details. We are currently drafting an agreement with the York PA hamfest to sponsor an ATV forum. Positive plans will appear here.

WB2OSZ John Langner of Chelmsford, MA wrote to say he is on SSTV using a homebrew interface software for an Atari ST Computer. Maybe we can get John to do an article about it for ATVQ!

Bob Raynor W6LUY is Simi Valley, CA wrote to say he is on 440,900 and 1250 ATV and also operates ATV from his Cessna 182! We hope to get some pix soon of his Aero ATV operation.



Sylvia chats with June & Vic about ATV in central Florida.

ATV OPERATING NEWS

ENGLAND

Andy Emmerson 71 Falcutt Way, Northampton, England NN2 8PH G8PTH is looking for test patterns and station ID slides from broadcast TV stations. Anyone out there with access to cast-offs? Andy would most appreciate being able to add any stations to his collection. Andy will pay postage or let him know if you want anything from England. Had a very nice telco qso with Andy which resulted in the invite of ATVQ to England for the BATC conference.

BOSTON

In the last issue we mentioned the TV guide articles about ham TV. The August 27th issue story was started by a phone call to Henry Ruh (Sr) who then put TV guide in touch with Henry Ruh (KB9FO) who then supplied much info and leads to the other folks in the article. We received a very nice thank you note from Joanmarie Kalter the TV Guide staff writer for our contributions. Press releases were sent by Henry to all the ham magazines. World Radio and at least 1 of the "big four" reprinted the press release. Copies were also sent to the commercial network anchors at ABC, NBC and CBS NYC, and local station news departments of network stations in cities where people in the article live. The best response was when NBC Nightly News visited Ron K3ZKO in Philly and ATV received a few priceless minutes on Brokaw's show on Nov. 3rd.

We mentioned in the last issue that TV Guide had also did a story about the WR4AAG (now WA9GVK) ATV Repeater back in 1974 when it became the first ATV repeater in the country. Now that is a long lead-in but now the real story.

Mel Dunbrack W1BHD (his call since 1923) sent us copies of what we now believe to be the very first mention of HAM TV in TV Guide Magazine. JULY 18, 1952 features a story about Mel's being a "Video Ham". The story tells of Mel's ATV station and some of his equipment of the day. Mel says he is still a "Tube" man but is trying to convert.

For those able to visit, Mel has a TV museum at home with thousands of items he has collected. These date back to 1900! Equipment from all era's and modes of scanning adorn his home much of which was featured in APRIL 1951 QST! Mel's first ATV rig was a Scanning Disc in 1928-1929!! Can anyone top this? Thanks Mel.

CONNECTICUT

N1FHN and KA1KHZ in New Haven report simples ATV activity on 1285.25 every wed. 9 PM-10pm EST. They beam north from 9-9:15, east 9:15-9:30, south 9:30-9:45 and west 9:45-10:00. Especially looking for novices.

MINNESOTA

Justin E. Spinler K0GNH of R2 Box 101 Owatonna, MN 55060 is in great need of a MC790P IC or a replacement. Can anyone help?

Roland Paulson KB0GL of Minneapolis wrote to tell us that ATV got a boost in the twin cities when the channel 5 10 PM news crew visited his shack. They gave his ATV operation 2 minutes on their newscast. He reports that lots of folks called him to say, "saw your ATV on channel 5!"

Roland works both 439.25 and 910.25 ATV with a D1010 amp on 439 and preamps on both bands.

ILLINOIS

K9POX has a new call, NZ9E. Dave Miller of Niles is currently a RX only ATV'er but has operated SSTV for many years and regularly works Pitcarin Island and other rare spots on SSTV. Dave also QSO's using a public access VHF satellite which is used to provide communications in the south Pacific islands which other wise lack communications service. Dave's YL is Sue KA9UCK.

NEW CHICAGO ATV RPT EFFORT

According to K9SUN, ACLR a club in Chicago has been announcing its intentions to build an ATV repeater using 439.25 Mhz input and 910 Mhz output. Complete plans are not available at this time. However the ACLR group has FM repeaters on 10, 6, 2, 220, 440 and 1296. The ATV repeater will have a primary input on 1280 Mhz especially for Novices.

PEACOCK ATV CLUB

After two and a half years of trying PATC received its coordination from the Illinois Repeater Association for its proposed ATV repeater in Chicago utilizing 923 Mhz input and 427.25 Mhz output. The group is now looking for its 6th site having lost five due to the time delay caused by the IRA. PATC will cooperate with ACLR to provide crosslink operation and both will use VERTICAL polarization on 900 Mhz to be compatable. Both will have HORIZONTAL on the 440 Mhz band.

ANECDOTE OF THE MONTH

Bill WB8ELK spent a week at the ATVQ office and worked a number of stations from Henry KB9FO's ham shack. ATV contacts were made to Madison, Milwaukee, Davenport, several Ohio and Michigan stations up to 300 miles away on average band conditions with solid P3-P4 pix. On the last morning while removing some of the equipment to go mobile we noticed that the RX antenna lead from the down-converter had been plugged into the earphone jack of the TV set. We can hardly wait to see what happens when we connect it to the ANTENNA jack next time! Seems the Jr. Op Chuck had been using the TV set for computer display and had moved the cable for dad!

NZ9E

MORE ATV OPERATING NEWS

CALIFORNIA

The last space shuttle launch and landing and Pasadena Rose Parade was carried live on the W6NKF repeater on Mt. Diablo. Many comments on the Rose Parade program were heard on the local repeaters all of them congratulatory. Hats off to the So. Cal group (ATN) for a job well done!

The Black mountain group in South Bay have been busy on their antenna system. An experiment at linking the Diablo machine by picking up the 427.25 Mhz output showed a better antenna may be needed at their site. Also a possible solution might be a 900 link to the south bay area.

Up in Sacramento, Jim N6HOS and Bill WA6QIX have come up with a 900 machine on the air and at a fairly low level site. Jim has linked it to Diablo on 1200 several times allowing some of the locals access to the mountain top. Coverage from the Diablo site continues to amaze viewers. P-5 pictures at 100 miles away with a D1010 amp pumping out 80-90 watts on 427.25 and cable ready TV sets hooked to an outdoor R/S corner reflector antenna. Tune to cable channel 58 and you have pictures. Best DX input to the repeater so far is Bill WA6VZG coming in P5 on 1264 from Pine Grove in the Sierras some 80 air miles away.

Current plans are to improve the 1264 receiver system on the Diablo machine and add a time base corrector to the video chain to clean up the incoming signals. Currently in the works is the modification of the 30 watt commercial transmitter strip to furnish a separate aural transmitter on 431.75 with a combiner to use the same antenna as the big boys do. This will allow better picture power and no sync buzz in the audio channel. Also the separate transmitter will increase the audio reception a bunch.

Coming up this spring a non military space shuttle launch will give hours of shuttle video never seen by the general public and later the JPL Neptune flyby. Dates will be advertised as soon as we get them. 73 Don W6NKF.

Over 70 hams participated in the 100 mile Angeles Crest run. Last year ATV provided excellent link coverage along the route using low light cameras to follow runners progress during the night. Starting at the Wrightwood ski area the race is a tough one with a 19,000 foot gain and 24,000 foot loss vertical change in the mountains with the first 30 miles "at altitude" and the remainder over mountain trails ending at the Rose Bowl. Temperatures in the 90's took its toll as over half of the starting field failed to complete the race. Eventually only 49 of the 107 runners made it to the Rose Bowl within the 33 hour time limit. Many runners suffered from heat exhaustion causing stomach and muscle cramps. Runners were supplied with food, water and medical aid at 15 checkpoints. All runners entry and exit times were passed between adjacent check points on 2 meters simplex to insure none were lost or overdue. A remote base on 70cm FM located on Mt. Wilson (6000') relayed the 2 meter reports and aid requests to the Sierra Madre Search and Rescue HQ.

Excellent write up about the ham radio and ATV public service was included in a write up of the race in Ultrarunning Magazine including a long poem by one grateful spouse who was able to talk with and see her husband at an inaccessable aid station 6.6 miles away just after midnight 65 miles into the race. Fred K6KKD and Tom W6ORG operated full duplex ATV using 434 and 1289.25.

PORTLAND

From reports from WWATS, Portland is about to get its first ATV repeater. Dennis Belles WA7-DRO is reported to be sponsoring the repeater. Input is to be on 434 and output on 1253.25Mhz. Location is yet to be determined.

VANCOUVER

Robert Skegg VE7AII of Vancouver B. C. has an ATV repeater that he has been testing. Robert is looking for a site. The mountains above Vancouver would provide excellent coverage for ATV providing international service. Not much else is available at this time except that Bob has an ATV station in his RV. A few months ago he treated Seattle ATV'ers with live video while driving his RV ATV.

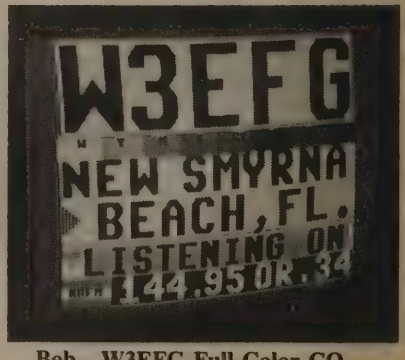
Three or four stations are reported to be on the air in Yakima according to WWATS.

VE7GO in Victoria B. C. is also active and providing Seattle ATV'ers with DX from the "Great White North". George often beams south on 434 Mhz and normally works 100 mi into the US. George was able to get equipment from several WWATS members to get ATV started in Victoria.

WWATS reports it is now incorporated as a non-profit Corporation in Washington. The effort was carried by Chuck W7SRZ, Dick W7TWU and Bob KG7E.

At their November meeting guest speaker was Dr. Alan Chandler of AEA who spoke on ATV equipment design.

Look for ATVers on 146.43, 443.55 or 224.68 in the western Washington area. Thanks WWATS.



Bob - W3EFG Full Color CQ.

MORE ATV OPERATING NEWS

NEW YORK

Carmen DeVito WA2GYX is building an ATV repeater for eastern Long Island. It is to operate on 434 in and 421 out. He has been experimenting for two years on the project. East-ern L.I. hams interested in ATV should contact Carmen. He reports that hams in western L.I. have been using the NYC ATV RPT but eastern L.I. hams ED W2WIA, Frank W2ORM and Carmen are trying to get activity going in their end of the world, closer to RI and CT than NYC! Hams in the northeast should tune down to 421 and look for the test videos. Carmen is very interested in getting reception reports. Carmen is retired from broadcasting and builds much of the equipment from scratch.

NYC area ATV'ers are reported to be on 147.45 for audio.

TEXAS

Austin Texas ATV RPT soon to be on the air after a great effort. Approval for the antenna site on a tower is Westlake was received January 9th. The tower is 100 feet high and sits on a 1000'+ hill. They report 7/8" and 1 5/8" coax is already in place. Initial testing will be at the QTH of N5MHL. A graphic ID board has arrived with four W5VDS/R id's. Bob WA2TMD designed the EPROM stored graphics.

GETTING THE BUGS OUT

After the site problem was solved the group set about to solve a desense problem in the ATV equipment. The receiver worked superbly well but when the transmitter was keyed a P5 signal became P1. Obviously the RF did not know that the Hammond boxes were "RF tight". The first approach was to make sure that the audio and video interconnecting cables and coax to the duplexer cavities was 100% shielded.

Frank Davis W5VDS assembled new cables using high grade RG58 with BNC connectors for audio/video and 9913 with N connectors for the RF lines. Also Pat WA8PLR improved the by-passing on the transmitter with better ground connections. This made a perceptible difference and if you squinted at the monitor it was almost P1. A couple stations could see some hazy outlines on the output frequency. After some serious head scratching about what to do next the observation was made that when the video line to the transmitter was disconnected much of the "desense" would disappear. Did this mean that RF was travelling from the transmitter video input to the receiver video output? A look at the transmitter on Frank's spectrum analyzer confirmed that there was indeed a lot of RF present on the video input.

Frank came to the rescue with a handful of filters of unknown type. We looked at the output of each and found some that attenuated the UHF RF and left the video untouched. Was this the solution? Not yet. The following weekend Glen Dawson WA5ZNT and Pat WA8PLR went into desperation mode and tried every technique imaginable to isolate the video line including using his VCR as buffer amplifier, RF chokes, optical coupling by shooting a monitor with a camera. Frank reported from Wimperly that he had found a bonafide 100 Mhz low-pass filter and we jumped in the car and met him half way to pick it up.

None of these experiments eliminated the desense but they did convince us that RF on the video line was not the primary culprit.

The next weekend GLen, Frank and Pat set out to tighten up every thing that could conceivably allow RF from the transmitter to get into the receiver. New 500 pf feed-through caps were ordered express from Chicago and installed.

An outboard box for the BNC and bypassing was attached to the receiver, shielded power cables, mini-hardline, connectors, lots of shielding tape and similar items were added. Did it help? Yes! There was noticeably less desense but still not adequate.

As for color and sound.. don't even ask. Pat's suspicion was turned to the duplexer cavities. Were they just not doing the job? He called Beaumont, Steve Gomes KE5O who has an ATV repeater there. Did he have any suggestions for the RX/TX isolation and construction techniques? It turned out we had already tried all the standard techniques. But he did suggest looking for leaky spots in the boxes and lines. We did try different configurations and with the interdigital filter between the transmitter and amplifier the desense was totally gone!

The PC exciter is very wideband to the point of being sloppy and filtering before the stuff reaches the amplifier is very important.

Kenny Guillot WB5JLZ in Baton Rouge was then called as he had constructed his ATV repeater with the same TX/RX duplexer. Kenny was very eager to help and outlined problems that he had encountered with desense. He had discovered that the final trim cap in the transmitter was very critical and could giveth and taketh away the desense. An amazing discovery!

Finally on Jan 8, Jon Penner N5MHI and Pat worked on providing shorter RF paths to the duplexer and further tuning at his QTH. With more tweaking and cursing! Finally we saw color on the output. WOW! Bill Wehling KF5NB reported seeing a red blob on the image of the Corvette we were shooting. More tweaking and he could see it was a car. So far so good. Still barely detectable, distorted audio. Ron Pierson KG5BZ ran the test with the audio and we found the right place for the subcarrier injection level and there was audio that sounded pretty good most of the time.

So a lot of progress has been made but there are still a bunch of bugs that must be worked out. Thanks to everyone. From the Austin Amateur TV Club newsletter, "Camera Amateura" Joe Fisher K5EJL, editor.

STILL MORE ATV OPERATING NEWS

LOS ANGELES AREA

After almost two years, the Mt. Wilson ATV repeater K6KMN is back on the air. Doug Moon reports that many "old timers" are comming back on and getting their rigs out of moth balls. The repeater has been improved with new racks, improved rx/tx equipment and new coax.

As of July 4, 1988 a new Monday night ATV net has been started. So far the response has been very encouraging. Time is 8 PM through the Mt. Wilson 1241 video and 146.43 FM. Typically 15-20 video check-ins each night plus several more 2-meter only stations.

Rose Parade video was aired with excellent results. As well as the NASA repeated video of the last shuttle landing.

Future plans include a link to the high desert alternate frequencies and higher output. Suggestions and persons willing to help should contact Doug at PO Box 40, Mt. Wilson, CA 91023. Phone 818 440 1116 (work). The repeater input is 434 Mhz and requires TV sync. Output is 1241 video with +4.5 audio subcarrier. The FM repeater is 449.30 Mhz (pl) and 146.43 audio is on the ATV ID. TNX K6KMN.

DENVER

N0IVN Ron Hranac reports that the ATV'ers in his area got together and transmitted BTSC (Broadcast Television Stereo Committee) stereo on FSTV. This is the first effort we know of to transmit stereo TV audio on ham TV. Using CATV equipment they transmitted morse code on the left channel and voice on the right channel while full video was also being transmitted. They received some publicity for it in cable TV industry publications. They are now experimenting with SSTV on the SAP (Second Audio Program) to add a third audio channel to their signal. Ron uses converted cable TV equipment in parts of his station including a modified line extender to boost his exciter to 1 watt on 450Mhz. Ron's DX record is 11 miles on 10 milli-watts!! Ron also works SSTV.

CLEAR LAKE CALIFORNIA

W6LOU Clear Lake California 100 miles north of San Francisco has a new ATV repeater! Located at 2000' altitude with an input of 434.00, 911.250 and 1252 Mhz and an output of 426.250. The location is near Mt. Konocti and covers the Clear Lake, Sacramento area. They are limited on output power because of USAF at Marysville, CA which causes interference on UHF.

MINNESOTA ATV ACTIVITY
MIKE HERTEL, KA0MIV

I would like to report on the newest ATV activity in south central Minnesota. I am running a P.C. Electronics TC70-1 into a Mirage D24N with a 10 element KLM beam antenna up 60 ft with good 9913 coax all the way. Since first acquiring this equipment at the 88 Dayton Hamvention, I have used it during Field Day activities with the Mankato Area Radio Club to establish a one-way video link with the St. Peter Area Radio Club Field Day site just 12 miles north. It worked great. I believe this was the first ATV activity of its kind to take place in south central Minnesota. Since then another ATV station has been put on the air by my friend Dave Miller, MBOKV. He is also running a P.C. electronics TC70-1 into a Mirage D24N with a 27 element KLM beam at the other end, height about 40 D24N with a 27 element KLM beam at the other end height about 40 ft. So far the QSO's have been great, with any local hams now using cable ready VCR's and TV;'s for receivers to share in the fun.

I'd also like to report that as a result of our local activity, a small group of about 4 hams in Waseca, Minnesota, some 30 miles east of Mankato have formed an ATV group and have been retransmitting NASA shuttle video, using a KPA5 from P.C. Electronics and Mirage amp. The group is spear headed by Denton Larson, WBOAUR of Waseca. I wished I had more details, but we are working towards establishing a permanent 2 way link from Mankato to Waseca.

I should also mention that another ham, Dale Cordes, WD0BWP of New Ulm, Minnesota, has joined the ranks with a TC70-1, Mirage D24N and 10 elements. New Ulm is 30 miles west of ManKato and some P1 to P2 pictures have been exchanged between KBOKV and WD0BWP. We are still working on improving that one.

That's the report from here, except to say that the challenge is out to the Minneapolis ATV group to establish a 2 way ATV QSO with anyone down here in south central Minnesota. After all it is only 70 air miles from Mankato to the Twin Cities. Any takers up there??? We will do all we can at this end, so let us know.

BRITISH COLUMBIA
ORIN BEEBE VE7BEE

In South Central British Columbia, about 150 miles north 2nd west of Spokane, Washington, lies the Okanagan Valley, home of a new group of ATVers, based in Penticton and Summerland, B.C.. This group has been on ATV only just over a year, but they are adding new members at the rate of about one per month! That's pretty good for this area of Canada where the total ham population of Penticton and Summerland--maybe 40 hams. We have about tweleve amateurs active in some capacity on ATV, mostly on receive and with a few, of course, with transmitters and cameras, etc. Typical terrain is mountainous region with soft peaks common; some are 7000 ft. Due to the Okanagan Valley running north and south, we have sent pictures about 20 miles with only 10 watts and small yagis at either end. The gorup hopes to have a 70 cm in 33 cm out ATV repeater (cross band on the air soon) operational in June of this year. This will allow more amateurs to join in the fun. Our system which we will be using is unique in some respects and I

thought that we should pass along the information. The reason for us as a group for coming out on 33 cm is two fold. 1) To allow the use of full duplexing of signals, in and out can be seen at some time, 2) to allow for the continued use of our very low cost down converters. I discovered that by using a 2 Mitisumi Satellite Receiver Block Down Converter, the type that used to be found in the older receivers, that we could tune the 439.25 Mhz ATV channel and the 911.25 Mhz ATV channel with one converter. How, you ask? Simple. The "old stuff" satellite downconverters such as those used in Anderson and other makes tuned a 500 Mhz wide frequency range from 420 Mhz to 920 Mhz or from 450 Mhz to 950 Mhz. (The second range can be converted by squeezing the first oscillator coils together lowering the frequency range.) The new satellite down converters in the new receivers, will not work at 70 cm but will work from 33 cm up to and including 23 cm. I have tried the latest ones which tune from 950 Mhz to 1450 Mhz and it works great on 23 cm with a two preamp for extra gain. Our typical receive set-up here in this area is as follows: (see fig.) Worked up to 10 miles snow free from 10 w transmitter with color. This system has worked great. It is not the most sensitive systems for receive, but it is one of the cheapest. Since most of the plans wanted to keep the initial cost down of setting up to receive, we thought we would go this route: Approx. Total Cost as Follows: 1-Radio Shack Corner Reflector for UHF or antenna craft: $15 Soft coax R659 foam with connectors $10. One Radio Shack or surplus satellite coax preamp $15. One surplus Mitsumi D.converter: $20. ATV Receive Total Cost: $60. (you supply box for D/converter and 12 VDC). $60 for a dual Band ATV receive set up that works good. Seems like a winner to me! Anyway in closing if there is enough interest, I can supply additional source materials for D/converters / pre-amps, write me directly.

As for 23 cm TX goes, others and I have been using P.C. Electronics transmitters and Tom's stuff works good for us up here. Hope this information will help. Some hams out there that go to flea markets and surplus houses get on the ATV mode. 73's. See you on ATV. VE7BEE ORIN.

BATC CONVENTION 1989
NEW VENTURE

The BATC Convention will be held on Sunday April 30 between 10am and 4pm at the COVENTRY CREST HOTEL. The hotel is located adjacent to JUNCTION 2 of the M6 (Coventry South). The club has booked the entire FOUNDERS SUITE, which is a custom built conference center. One advantage of this venue is that the suite is separate from the main concourse of the hotel, thus our 'activities' will not cause any disruption to the normal running of the hotel (at least that's the theory!). Another advantage is that there is a great deal more parking space, which should help alleviate some of the problems we have had at Crick. Due to the nature and size of the venue we shall not be using a marquee this year. The hotel management have agreed that the usual impromptu car boot sale may take place in the car park. A full lecture program is intended and this will be held in a separate room within the hotel. Please note that the doors will not open until 10am.

Owing to problems with the Sunday trading laws that have been looming over the club in the past, we are having to introduce entrance by program only this year. The programs will only be available at the door and will cost the vast price of 50p. This will allow us to ensure that all attending thee rally are members for the day at least, thus any sales/purchases are then classed as 'mutual trading', which is allowable on Sundays. Families will only need to purchase one program, as will adults accompanied by children under fourteen. Consequently, this change will mean that people will be required to man the doors throughout the day, so all volunteers will be gratefully welcomed.

The now standard feature of the "Bring-and-Buy" stall run by the GB3RT Repeater group will again be present, creating the usual state of mayhem around the stall. There will be a slight change to the B&B this year, in as much that there will be a nominal registration fee of 50p per item, refundable upon sale. This is due to the amount of abandoned equipment that the group has had to contend with after the show in the past! The commission will remain the same at 5% or 50p.m, whichever is the greater.

Another new feature, or at least a revival of an old one, is that we would like an exhibition of home-brew equipment. If you have anything associated with amateur TV which you would like the rest of the club to see, please bring it along. The club shall award a price for the best exhibit and this shall be judged by members of the committee.

A 'surgery' will be held where technically qualified members will be on hand to answer your questions and help with any problems. Again volunteers will be welcome.

Finally, and I offer no apologies for repeating myself, please don't leave it all to the committee; there are only 22 of us! Organizing and running a convention the seize of ours requires a great deal of forward planning and a great deal of work on the day. We need VOLUNTEERS to help man the doors and generally assist wherever necessary. We don't expect anyone to offer a whole day (unlike the committee does of course!), but a couple of hours would be ideal. PLEASE do not leave it to the other guy; offer a little help. Your committee will be forever grateful. (See fig.)

If travelling to the convention by rail, journey to Coventry station. From there a regular bus

service to the central terminus operates. Then take a bus tot he Walsgrave area.

If travelling by boat, the Oxford Canal (Northern section) passes through Ansty three miles out of Coventry on the A46.

If arriving by air, Birmingham International Airport is 12 miles away to the north on the M6.

A talk-in station will again be operating, provided this year by the Coventry Amateur Radio Society, to whom we offer our grateful thanks. The station will be operating on $22 (2m) and possibly SUB (70cm) and will be using the special call sign GBOTV.

ATV IN PARADISE
HAWAII'S FIRST ATV RPT

AH6IO Richard is putting together a434 in 421.25 out ATV repeater for the Honolulu area. It is intended to go up on Diamond Head or atop one of the high rise Waikiki area hotels. So if you ever plan a vacation among the palm trees and hula girls, take your ATV gear along and check with the gang at Honolulu Electronics.

FOR SALE

Large collection of broadcast type audio and video equipment. Unless otherwise specified equipment is like new. Most of the microphones are flat black or non glare finish. Price for all equipment is best offer or swap for certain ham gear or broadcast gear. WANTED: LARGE HF AMP, 160-10 FULL LEGAL POWER, NO JUNK, OR HIGH CHANNEL TV TRANSLATOR, MINIMUM 100 WATTS OR C BAND UPLINK HARDWARE OR 2 GHZ COMMERCIAL ICR TV RELAY TRANSMITTER/RECEIVER, ENG viewfinder for Sharp XC-820P pro camera. Also battery or AC supply for camera. (12 volt-15 volt, type 7700 battery).

FOR SALE OR SWAP: Prices indicated are asking price or swap value.

1. Panasonic AU9200 3/4" vcr. Can be used with or without TBC, has 2nd audio channel edit. Video in-out on BNC. Dusty but works OK. Includes new manual. Used to make copies for QCD not used in about 6 months. $350. SOLD

2. CBS model 1602 stereo audio DA 600 Ohm Z, 1 x 8. Very clean. Works fine. $200

3. CBS 4440 mono Audimax. Very clean, works fine. $200

4. Ward Beck M605A audio DA and DA tray. Like new. 600 ohm in/out 1 x 6. $150

5. International Nuclear Inc. Video DA. 8 units, 3 are 1 x 4 and 5 are 1 x 8 All are loop through input (bridging) All have pulse/video select, gain and eq controls. All working OK. $50 each.

6. NLS (Non-Linear Systems) miniscope, model 215, dual trace, 15 Mhz. Fine portable scope. Runs on ni-cads, with charger and probes. X-Y and usual displays. $250.

7. Cetec Vega wireless mic transmitter, receiver, Sony electret mic, ant, (Pro/R33) complete on 170 Mhz. Like new retail over $2200, Asking $1000.

8. Sony ECM55B mini lavalier mic, black, like new, $100.

9. Neuman BS945 phanthom power supply for mic, like new, $75

10. Neuman N452 fet 80 dual power supply, like new, $100

11. Shure FP32 stereo mixer, like new, $600.

12 Shure FP12 headphone briding amp and "IFB" type talent earphone. like new, $150,

13. Shure FP11, mic to line level amp, like new, $150.

14. Shure 512 mic/headset, minor cosmetic scratches $50

15. Audio Technica 4071 capacitor shotgun mic with windscreen $1200 list, asking $600 like new.

16. Audio Technica 835 electret shotgun with windscreen, $700 list, asking $400.

17. Audio Technica AT 4073 shotgun with windscreen, $300.

18 Sennheiser ME80/3KU/MZW30 shotgun, power supply, windscreen. $300.

19. Sennheiser MKE2-2R micro lavalier, black. $150.

20. Porta-Brace bag, model cc505P, slight wear, holds pro ENG camera or other goodies. $100

21. Collection of Audio Technica mic cables. $50 for lot.

22. Tektronix 529 rack mount broadcast waveform scope (as received back from QCD) was working when I lent it to him, came back missing fuse. $75.

23. Whiteway Sign computer/control terminal. $50

Items 7-21 are owned by Chicago pro video shooter getting out of business. For any/all above, contact: Henry KB9FO, 540 E. Oakton, Des Plaines, IL 60018 312 298 2269.

CLASSIFIED ADS IN ATVQ ARE FREE TO SUBSCRIBERS.

KB9FO ARRAY.

DAYTON ATV PARTY

ATV operators are invited to enjoy and enter a Home Brew Contest and casual QSO party while at the Dayton HAMVENTION and win prizes for Home Brew ATV projects.

Amateur Television Quarterly Magazine (ATVQ) is sponsoring a Friday night, from 7:00 p.m. to midnight, ATV QSO party and Home Brew Contest at the Travel Lodge Motel (formerly La Quinta). The Home Brew Contest is open to Ham TV projects and prizes will be awarded including $100.00 first prize.

Free coffee, soft drinks and snacks as well as display tables for Home Brew Contest entries.

Entries must be accompanied by a short write-up not to exceed two typewritten double-spaced pages. Other prizes to be announced.

A NEW HAM TV MAGAZINE

Amateur Television Quarterly. A high quality technically oriented ham TV magazine.

PROFESSIONAL STAFF FOR EDITING

In the tradition of the BATC, CQ-TV, Ham TV in the US needs a technically oriented ATV magazine. Amateur Television Quarterly is being started to fill this need. Each issue will cover technical subjects, build-it projects, equipment reviews, theory articles and operating news. Each issue will have virtually **no** editorial content except for FCC and operating news. Each edition will be edited by a professional staff of technical and journalistic experts. Not every item submitted will get published unless it passes our editorial and technical staff.

VALUABLE CONTENT

The first issue is expected to be out in January of 1989. Each issue should be at least 48 easy to read pages. That's 48 pages of useful information not 12 pages of ads for in house products and promotions.I Areas covered will be FSTV, SSTV, video and related subjects. Our internal text paste up is done on daisy wheel and laserjet printers . . . no hard to read dot matrix fonts!

YOUR INPUT NEEDED

In order to succeed we encourage your input. This can be in the form of articles, operating news, subscription or comments. Amateur TV Quarterly will PAY for your technical articles. You won't get rich but it will keep you in typewriter ribbons. Our initial distribution of 4,000 copies will make you famous! This may mean even more issues per year if response is large enough! Well known ATV'ers have already submitted prime material for the debut issue.

YOUR RESPONSE PLEASE!

I don't want to miss out and my subscription is enclosed.

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☐ 4 YR	$45	$65	$65	
☐ 5 YR	$50	$70	$70	

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operate: FSTV SSTV FAX other _____

ATV/SSTV bands _____

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Best ATV or SSTV DX _____

Grid locator or Lat/Lon. _____

ATV RPT? _____ QTH _____

Station Equipment _____

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Comments: _____

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Amateur Television Quarterly.

1545 Lee St., Suite 73

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One last advantage, a business phone you can call: 312 298-2269

FOX HUNT RADIO DIRECTION FINDER

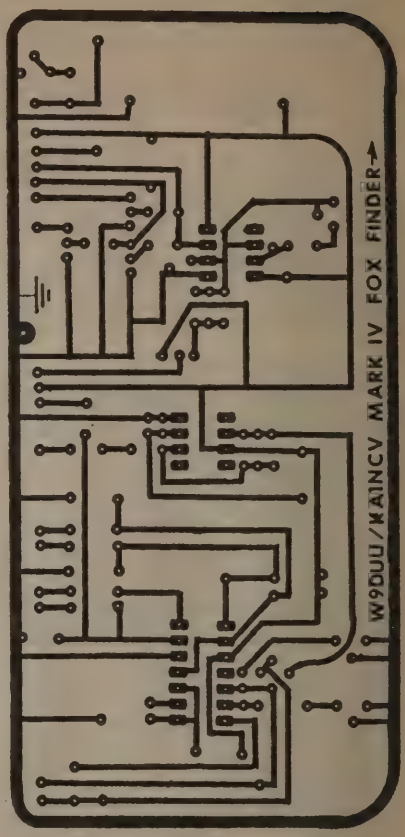
Paul Bohrer W9DUU

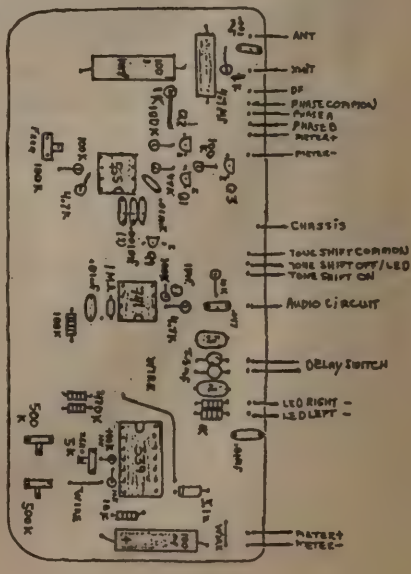
How often have you wished for a simple RDF which could work on just about any band and provide you with both an aural and visual means of determining the direction of a signal? You may have wanted to find an errant transmitter, QRM source or just have fun finding the "FOX" or more seriously search and rescue or recovery. Now you can do it. The author is chief engineer for WTTV channel 4 in Indianapolis. He and several other ATV'ers in the area have built and use the unit described here. Success in finding transmitters is easy with the unit. Recovery of WB8-ELK's balloon ATV transmitters was done with these units. Construction is not critical just use good construction techniques. You will undoubtedly want to build it in a rugged manner to survive the environs of mobile/portable operation and trekking through the wilds.

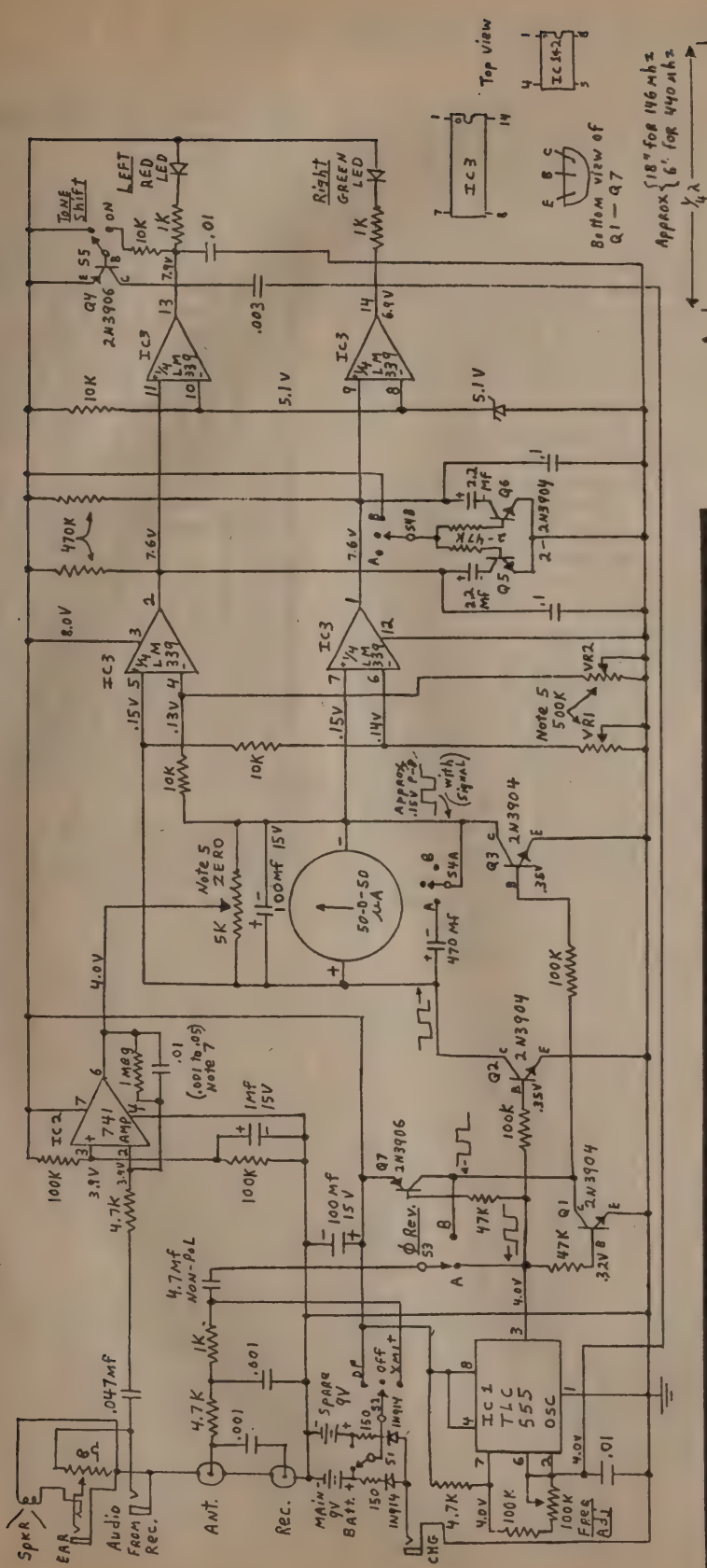
NOTES: Battery voltage =8 when readings were taken. V on LM339 pins 1, 2, 4, 5, 6, 7, 13, 14 depends on setting of VR 1 & 2. Battery drain = 7 ma with no signal and about 13 ma with signal with either LED lit. Antenna and receiver jacks should be mounted as close together as possible. Use short leads on the two .001 caps and the 4.7k resistor. Mount the 4.7k resistor at the antenna jack. The length of the coax between the antenna and the switching diodes is not critical however, they should be EXACTLY the same length. With no signal, adjust the meter ZERO pot for zero meter reading then adjust VR 1 and 2 so that the LED's just extinguish. With signal applied rotate the antenna for max meter deflection. Adjust the receiver audio level to just produce full scale meter deflection. The size of the cap between pins 2,6 of the 741 can be picked for desired sensitivity. For example, a .05uF cap will require a higher volume setting on the receiver for a full scale deflection than will a .001uF. Adjust the osc frequency for equal left-right meter deflection with signal supplied. Use S4 in the "A" position for averaging meter flutter when in high multipath areas and in "B" position to store LED left-right readings when DF-ing ker-chunkers. Leave the switch in the center off position for normal DF-ing.

PARTS LIST

Quantity	R/S P/N
1	276-1718 555 timer
1	276-007 741 op amp
1	276-1712 LM339 cmos 5
	276-1603 2N3904 or eqiv.
2	276-1604 2N3906 or eqiv.
1	276-041 red led
1	276-002 green led
1	276-168 pcb
1	270-286 box (user choice)
2	274-253 mini jack
1	274-286 mini plug
1	274-1565 coax jack
2	278-239 SO-239 jack
1	40-245 2" speaker
2	270-325 bat snap conn.
2	23-126 9V nicad bat
2	270-326 9V bat holder
1	272-1434 1mF 35v tant.
2	272-158 / 272-135 .1mF
1	272-157 / 272-134 .047mF
6	272-126 .001mF use 3=.003
3	272-156 / 272-131. 01mF
1	272-957 470 mF 16V
1	272-998 4.7 mF 50v nonpol
2	272-1028 100mF 33v ele.
2	271-339 500K min pot
1	271-217 5K pc pot
1	270-047 8 ohm spkr vc
1	271-338 100K min pot
3	275-625 mini spdt switch
1	275-325 spdt center off
1	271-019 470 ohm
3	271-1330 4.7K
2	271-1312 150 ohm
3	271-1321 1K
1	267-565 5.1V zener
2	271-1335 10K
4	271-1332 47K
7	271-1347 100K
2	271-1356 1 meg
2	276-1122 1N914
2	ecg 553 pin diode







A 10 UH INDUCTOR

J. CRONK GW3MEO

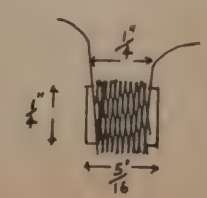
CCIR pre-emphasis networks, widely used for FM-TV, use 10uH inductors which are not often found in junk boxes. Although Electromail (RS) stock them under part number 228-141, as do Bonex Ltd, it's useful to be able to make one yourself when it is needed.

Since most amateurs don't have access to an inductance bridge the following method should prove close enough for most purposes.

Cut a standard 1/4" diameter by 5/8" long coil former ferrite core in half. Wind on a 20" length of 30swg enamelled copper wire in a small pile about 1/4" long and secure with a blob of glue or wax. The other half of the core may be used for the same purpose so that you have a 10uH inductor in stock.

The inductance can be checked with the aid of a dip meter or oscilloscope and LF signal generator, in which case 2,500 pF in parallel should produce a 1MHz tuned circuit. (see Fig.).

Half of an Aladdin core wound with 23 turns of 30 S.W.G.



HETERODYNE FM TELEVISION TRANSMITTER

BY DAVE WILLIAMS WBØZJP

This approach to FM Television as certainly not the only way nor is it necessarily the cheapest way but it does make a nice modular transmitter and serves as a building block to using the same technique for the 900, 1200 and 2300 MHZ amateur television bands.

The transmitter consists of five modules. 1. A video amplifier using an NE592 differential video amplifier ic, the second module is the FM60-70 MHZ modulator. This module is based around the NE 564 phase locked loop ic. The third module is the FM sound modulator at 6 MHZ . The fourth module is a wideband IF amplifier using the Motorola MWA120 wideband RF amplifier module. The fifth module is the heart of the transmitter. It consists of the local oscillator, the double balanced mixer and RF amplifiers.

The idea of this transmitter is to build a high quality FM TV transmitter complete with preemphasis network, FM sound generator and FM video modulator operating at an IF frequency and then up convert or heterodyne via a mixer and local oscillator to the final operating frequency. In this way you can use one common IF FM transmitter to feed various transmit mixers on 400, 900, 1200, 2300 MHZ, or higher.

The first module is the video amplifier. It uses an NE 592 differential video amplifier chip. This has a band width of at least 100 MHZ and an adjustable gain of 0-400. I used this choice because it provides a good termination for the video and has sufficient gain to drive the pre-emphasis network. Frequency response was very good, showing no discernable high frequency roll-off.

The second module consists of the pre-emphasis network, which confirms to CCIR recommendation 405-I for 525 line U.S. standards and correctly matches the response needed for the de-emphasis network used in the satellite receiver used to receive the FM TV signal. The FM modulator has separate inputs for video and the 6 MHZ audio subcarrier. Independent input pots are used to set the levels. A 10PF variable capacitor is used to set the operating frequency. This should be set with no video and no subcarrier audio signals applied. The range is roughly 40 to 80 MHZ. I use mine around 60 MHZ. The output is very low, around -16 DBM. This design came from C.Q. TV magazine.

The third module is the 6 MHZ sound subcarrier generator this circuit was found in CQ-TV magazine and is by far the nicest circuit I have found. It is quote involved and a P.C. board layout would be nice, but I build mine on PERF board and it works fine. It is based around the RCA CA-3046 D.I.P. chip transistor array.

TR-1 and TR-3 from an emitter coupled oscillator. A portion of TR-1 current flows through TR-2 and L-1 and frequency modulate the oscillator. The LM747 dual OPAMP is used as an audio amplifier and is used as an audio filter. Frequency response is 60 Hz to around 10Khz. Input impedance is 10K OHMS and is at line level.

The fourth module is a wideband amplifier used to amplify the modulator output to an acceptable level to drive the double balanced mixer. The MWA 120 is Motorola's equivalent to the MMICS marketed by Avantek and Mini Circuits Labs. The 1DB compression point is +8 DBM so running at 0 DBM is well below the compression point of the device. It is class A device and requires only an input and output coupling capacitor, bias resistor and bypass capacitor for the D.C. line. It is unconditionally stable and has around 14 DB of gain. I see no reason why one of the Avantek or Mini Circuits MMICS wouldn't work just as well.

So now we have a 60-70 MHZ FM TV transmitter with 6 MHZ subcarrier audio operating at about 1 MW out. We now need to take this and drive a mixer to Heterodyne up to the frequency of choice.

On 400 MHZ, I use a Hamtronics XV 4-9 transmitting converter. This uses a local oscillator operating at 378 MHZ, an SBBL-1 Mini Circuits doubly balanced mixer, and three stages of RF amplification. This unit works very nice and is also what i use on AM TV simply by replacing the FM modulator with a Dynair TX4A AM TV modulator.

On 900 MHZ, I use a local oscillator board developed by the R.S.G.B. (Radio Society of Great Britain). This was featured in February 1983 QST and is in the RSGB VHF, UHF manual. This operates with an overtone XTAL in the 90 too 110 MHZ range. The output is filtered to use a harmonic. This is fed to the mixer, and the output is filtered and fed to a Toshiba SAU-15 which drives an SAU-11 900 MHZ power module.

I see no reason why a commercial trans-verter for 900, 1200, or 2300 MHZ would not work just as well.

So, this should give you a basis for a Heterodyne FM TV system. Hope you have as much fun building it as I did. See you on FM TV.

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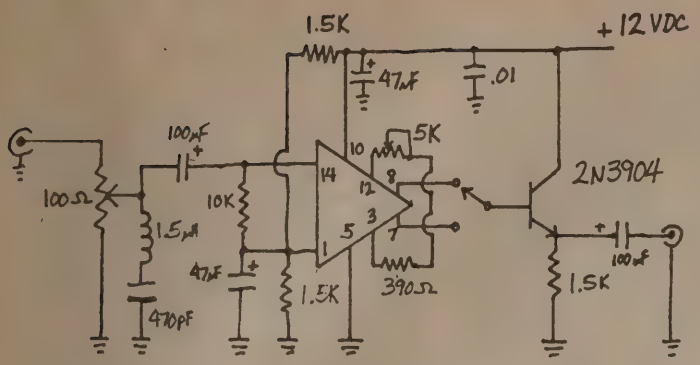
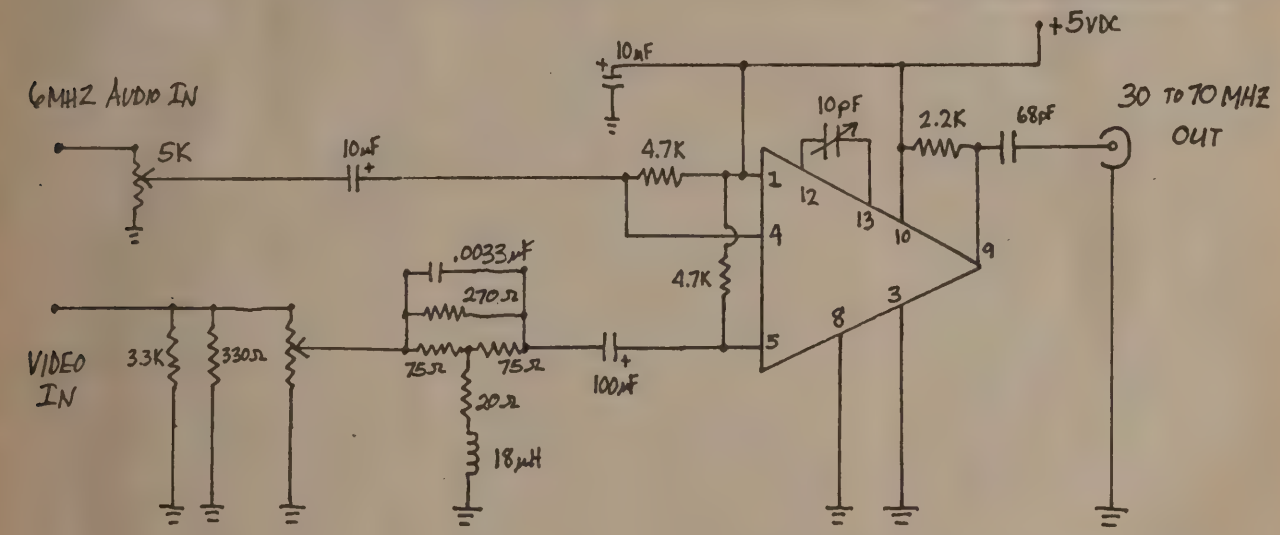


NE-592 VIDEO AMPLIFIER

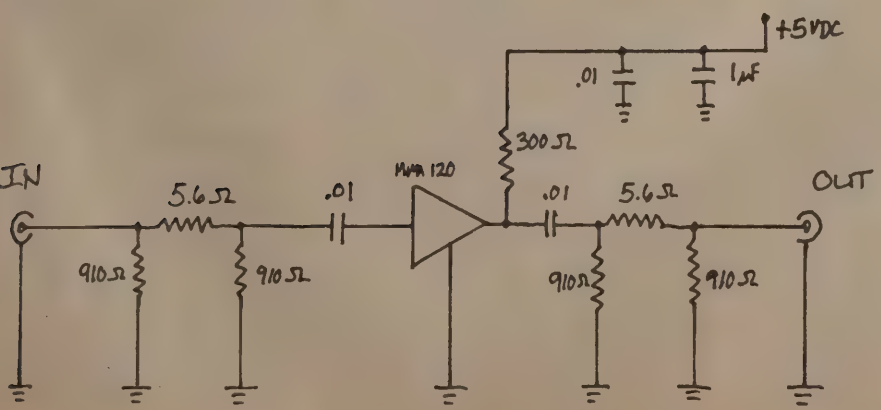
ELECTRONIC COMPASS

Bill WB8ELK

For those involved in T-hunting, the Flux-Gate Electronic Compass model 63-641 sold by Radio Shack should come in handy. Just mount the remote sensor on your direction finding loop or beam. The electronic compass mounts on your dashboard and provides a readout of the true antenna bearing independent of your vehicle's heading. You will have to extend the cable between the sensor and the readout unit however. This should save invaluable time when tracking down those hidden signals. Thanks to Scott Bovitz, N6MI, of the LA T-Hunters for this info.



NE-564 FM TV MODULATOR



MWA-120 WIDEBAND R.F. AMPLIFIER

Continued on page 40

POOR MAN'S SPECTRUM ANALYZER/MONITOR RECEIVER & TRACKING GENERATOR

MURRAY BARLOWE, WA2PZO

Imagine if you will, a single piece of equipment that could provide you with the ability to be able to: Check your transmitter output for "spurs". See if the band is "open" at a glance, or find a quite spot on the band. Monitor ALL the local repeaters SIMULTANEOUSLY! Receive "on-carrier" or "sub-carrier" ATV sound. Examine Satellite TV signals and their sub-carriers. (Curious about those "secret" signals on the Cable?) Measure the amplitude and frequency of RFI generated by your computer, electrical appliances, etc. and instantly evaluate the results of filtering or shielding. Orient and tune antennas (and antenna tuners) for maximum results across a band of frequencies. Sweep an area for illegal "bugs". Identify modulation modes such as AM, FM, SSB, FSK, PCM etc. Signal trace transmitters and receivers, check "gain per stage" when building or troubleshooting and test for harmonic or intermodulation distortion. Tune antenna duplexers or diplexers, make VSWR measurements, measure insertion loss and tune RF filters. Make field strength measurements. Act as a continuous tuning AM FM, VHF/UHF sound receiver. These are only a few of the applications for the New Science Workshop Spectrum Analyzer/Receiver. With "RF-Vision" you will have a new monitoring mode, with rapid signal detection, modulation analysis and band condition and activity information constantly available at your finger tips! Through its many applications, this new instrument provides information and operating techniques not available in any other way.

SOME HISTORY

Back in 1978, I assembled a few pieces of surplus electronic gear into what I affectionately called "The Poor Man's Spectrum Analyzer". I demonstrated it at the Dayton Hamfest and sold out on the first day. One of the key items was a surplus TV IF strip which I had narrowbanded for this application. I found a few more, sold out again and then we were out of the Spectrum Analyzer business! The excitement created by this extremely low-cost approach to spectrum analysis and display inspired me to see if I could design a simple circuit that could do all that the original package did, and maybe a bit more.

Well, we've done it! The new design is simpler, more stable and has greater dynamic range. How could we do all this and still come up with a package that meets the economical goal of being called the "Poor Man's Spectrum Analyzer"? Simple. Careful compromise! We would all love to have an instrument which would have all of the features of the $30,000 machine or even settle for the features and accuracy of the $5,000 machine. But we also realize that it's not in the cards for under $100. How about a machine that would do ALMOST everything the professional models do, but one that would require a little more effort and ingenuity on our part when it came to making precise measurements? Isn't half a loaf better than none? Many times it is and I believe this is one of those times. The original kit was based on these assumptions, and we made lots of friends with it! The results both in performance and educational value are impressive. Once you've had the opportunity to use it and appreciate its potential you will probably find applications that we haven't even dreamed of! (see Fig 1)

HOW DOES IT WORK?

Basically, the "Poor Man's Spectrum Analyzer" sweeps a voltage tuned front end over a range of frequencies in synchronism with the horizontal sweep of a scope. The received signal is passed through a narrow band filter and the detected signal is applied to the vertical amplifier of the scope. No signal, no vertical deflection. The deflection produced by the signal is proportional to the received signal's strength. Resolution is approximately 200 Khz, which is determined by the bandwidth of the filter.

Since the output of the analyzer is audio, it can use ANY SCOPE for the display! If you don't have one pick up the cheapest "flea market special" that produces a horizontal line! The analyzer functions as a TUNABLE RF VOLTMETER with "eyes" and "ears". This makes it a natural for signal tracing receivers and transmitters, making relative gain-per-stage measurements, tuning transmitters, receivers, antennas and duplexers, locating and identifying sources of RFI, checking receiver local oscillator radiation, transmitter spurs, remote off-the-air repeater transmitter monitoring, etc. Using the analyzer on a transmitter, provides a display of the frequency, amplitude, and purity of the oscillator, frequency multiplier, and final signals. While a watt meter indicates the total power output of a transmitter, the analyzer will tell you how much of that power is the desired output signal and how much of it is garbage. Have you ever "peaked-up" on a spur? How would you know? Wouldn't you like to see the level of the synthesizer sidebands? The harmonics?

The high sensitivity of the instrument permits signal tracing receiver circuits from the antenna through the low-level RF stages. If the output of an RF amplifier stage contains signals not visible on the input, the RF stage is generating distortion products as a result of either overload, incorrect bias, etc. A conventional RF voltmeter (or scope) simply sums all of the voltages with no indication of the individual frequency components. Not so with the

HOW DOES IT WORK?

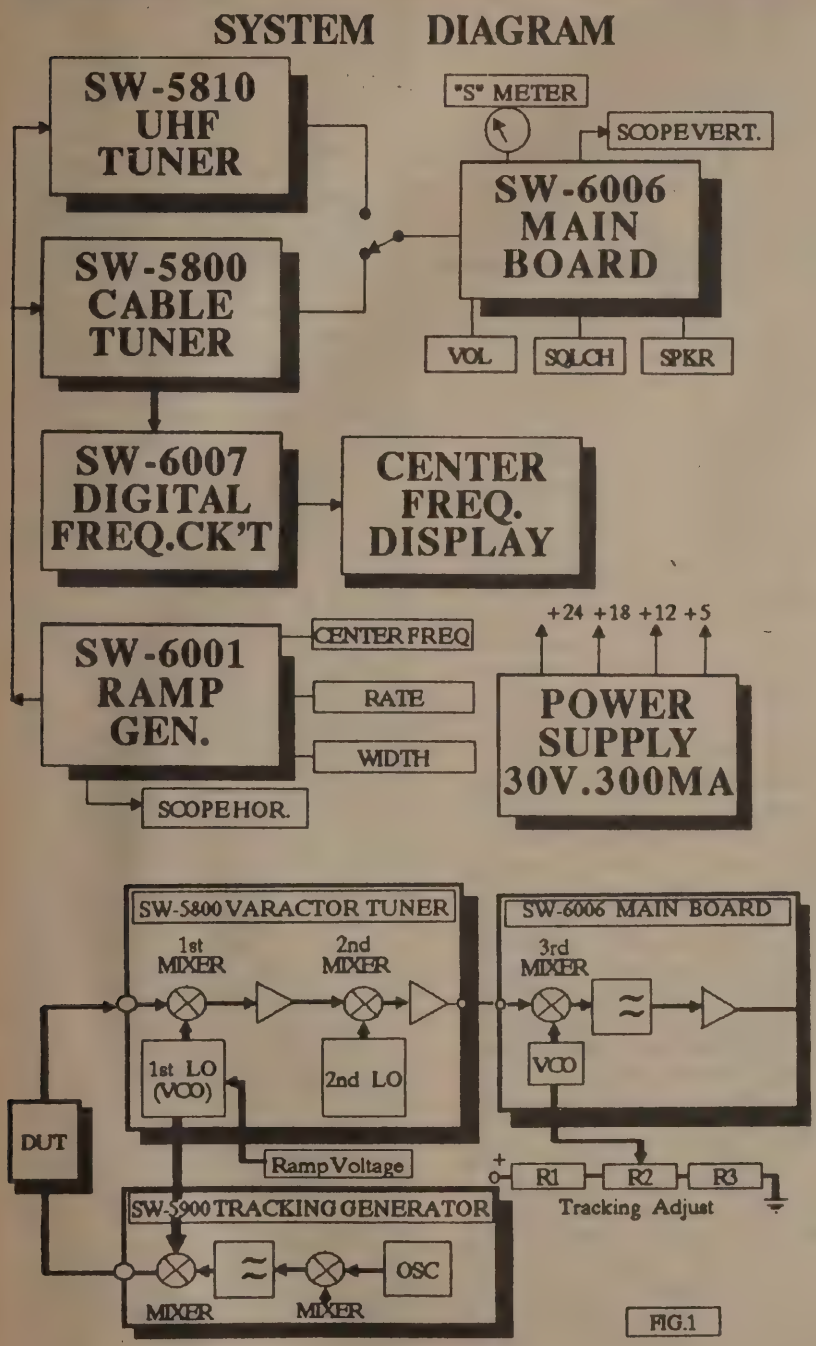


FIG.1

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Spectrum Analyzer! In addition, the analyzer displays the presence of the local oscillator signal, as well as its frequency and injection level.

The Science Workshop "Poor Man's Spectrum Analyzer/Receiver" may not provide you with the built-in calibration convenience of its bigger brothers, but it will provide you with a basic instrument that will teach you how a Spectrum Analyzer works, do all the good things we've described, provide you with a continuous tuning AM/FM, UHF/VHF sound receiver and best of all, its price GUARANTEES NOT to make YOU A "POOR MAN"!

WHAT DOES IT COST?

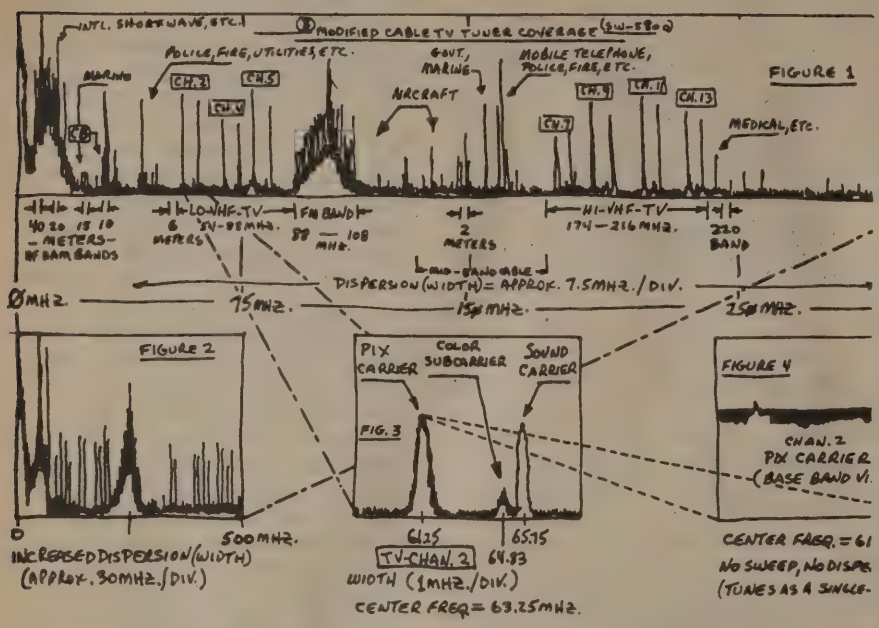
The "Poor Man's Spectrum Analyzer/Receiver" has been designed and packaged as a semi-kit to provide the cost-conscious Ham/-Experimenter the opportunity to assemble this unit at the lowest possible cost. The heart of the instrument is what we call the "Main Board Assembly". It contains the converter, IF filter, amplifier-/detector and audio amplifier sections. All on a 3" X 4 1/2" PC board. Complete kit of parts for the "Main Board Assembly" is $30. We can also supply this board assembled and tested for $20 more.

WHAT ELSE DO I NEED?

A sawtooth horizontal sweep voltage is required to deflect the beam horizontally across the screen of the scope, and at the same time, causes the varactor tuner to scan across the RF band. Many scopes provide access to the internal horizontal sawtooth voltage. If your scope does, that's all you need. Our instructions show you how to use it. If your scope doesn't, we've provided another kit which uses a single LM-3900 chip to do the job. It also provides a voltage regulator and the circuitry necessary to integrate the controls for "width", "sweep rate" and "center frequency". Makes it a lot easier to assemble your analyzer even if your scope provides the horizontal sweep voltage. Order Ramp Board

RF VISION FROM SCIENCE WORKSHOP

THE VIEW FROM THE ANTENNA HERE IN BETHPAGE, NY.



#SW-6001. Kit $20; assembled $10 more. To finish the project, you will have to provide a box, controls, knobs, speaker and power supply.

WE GET LETTERS, LOTS & LOTS OF LETTERS...

"Recently purchased your Spectrum Analyzer kit. It was assembled in a few hours and worked perfectly the first time out. I am delighted with your unit that compares in many aspects with Hewlett Packard, AVCOM and Tektronix spectrum analyzers costing many thousands of dollars more. We use it for looking for 6 meter openings and identifying the type of scrambling being used on Satellite TV signals. It is a real pleasure using your Spectrum Analyzer, compared to trying to guess looking at a standard TV display. There are only so many different ways a satellite TV programmer can scramble a signal and "all" of them are rather obvious when one looks at the audio and video on a Spectrum Analyzer. Also pick up the 123-136 Mhz aircraft band, 2 meter band and weather bureau from Toronto, 130 miles away. " Robert M. Richardson, W4UCH, noted author of "The Gunnplexer Cookbook", "Disassembled Handbook for TRS-80", and "Synchronous Packet Software Approach",

SEVERAL MONTHS AFTER WE RECEIVED HIS UNSOLICITED LETTER, HAM RADIO MAGAZINE (SEPT. '86) PUBLISHED HIS ARTICLE TITLED "LOW-COST SPECTRUM ANALYZER WITH KILOBUCK FEATURES". WE QUOTE...

"Although laboratory-grade spectrum analyzers cost $4,500 or more, you can build a spectrum analyzer offering many features of its costlier cousins for about $50 (Main Board & Tuner). How can such amazing capabilities be had at such incredibly low cost? Through the use of a commercially mass produced varactor TV tuners. Through the use of consumer grade integrated circuits in the oscillator/mixer, dual ceramic filter, IF amplifiers/detector, and audio amplifier (offering audio as well as scope output, it is really a spectrum monitor). Through the use of your own oscilloscope. Just about any scope may be used. I used a 1951 Heathkit Model OL-1 with its original cathode ray tube".

AND ANOTHER...

"I was very fortunate to have purchased your "RF VISION" kit. I originally used it for listening to signals and just seeing what was on the band...My real interest was in using it as a spectrum analyzer. It has done this remarkably well. Another area of interest to me is antenna measurements. I have used a Palomar Noise Bridge for several years, and with the help of a computer, I have been able to calculate some good data on my antennas. The final data being converted manually from tabular form to graphs. It occurred to me to use your unit as the detector in place of the normal receiver. You can well imagine my excitement in seeing my antenna graphs appear on the CRT without any laborious data gathering or calculations! I am so pleased with this project that I have recommended it to several friends and plan to demonstrate it at a club meeting in the near future. It is hard to believe an electronic tool could generate so much pleasure, but this one did. Thanks again for many hours of pleasure". Terry Good, WB2PFB, Hillsdale, NJ

AND FROM JOE CARR'S "PRACTICALLY SPEAKING" COLUMN IN THE MAR. '87 ISSUE OF HAM RADIO MAGAZINE.

"Sheer genius!...WA2PZO deserves accolades and our business because of the Poor Man's Spectrum Analyzer project, which offers opportunity for experimentation in areas previously closed to amateurs solely for reasons of cost. I plan to buy the Tracking Oscillator Kit if and when it becomes available."

NOW, ZERO TO 500 MHZ IN ONE CONTINUOUS SWEEP!!!

We have acquired a quantity of NEW cable tuners (with prescalers) which we have modified

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for our application. They now provide continuous tuning from approximately 0 to 600 Mhz. The drawing on the back of this page illustrates what we see (and hear) when we connect this tuner to an antenna here in Bethpage. Adding a UHF tuner gives us the ability to tune from approximately 0 to 900 MHz! Since the resolution of the analyzer is approximately 200 KHZ, it is difficult to resolve signals at the low end. It should be possible to improve this with crystal filters. The pre-scalers makes it possible to add additional circuits to provide a direct, digital read-out of the center frequency.

SW-6900 TRACKING GENERATOR

The addition of a tracking generator to the spectrum analyzer provides a powerful receiver system for stimulus-response measurements. A tracking generator is a signal source whose RF output follows (tracks) the tuning of the spectrum analyzer. Since the instantaneous output frequency of the SW-5900 matches the instantaneous input frequency of the analyzer, this swept frequency test system acts as a very sensitive synchronous detector. This makes it the ideal set-up for measuring the frequency response of active and passive devices such as amplifiers, mixers, couplers, attenuators, transmission lines, and even antennas when used with an external bridge. Its output signal is generated by mixing two or more oscillators. Physically, the tracking generator consists of another modified cable tuner, designed to operate in conjunction with the SW-5800 modified cable tuner.

Figure 1 is a simplified block diagram of the system. The incoming signal to the spectrum analyzer mixes with the LO, and when the mixing product equals the IF, this signal passes through to the detector. The detector output is amplified and produces a vertical deflection on the CRT display. The sweep (ramp) generator drives the horizontal CRT deflection and tunes the LO. The tracking generator uses the swept LO from the spectrum analyzer and mixes that LO with a fixed IF oscillator. The sweep of the two instruments are matched and synchronous, and precise tracking between the two is assured.

TYPICAL APPLICATION.

The RF output from the tracking generator is connected to the input of the Device Under Test (DUT) and the output of the DUT is connected to the input of the spectrum analyzer, as in Figure 1. The resulting display is an instantaneous plot of the frequency response of the DUT. If you were adjusting a bandpass filter, you would immediately see the result of your tweaking. The tuned (sweeping) receive bandwidth of the analyzer assures that you are not peaking on a harmonic or any other spurious energy.

ANOTHER APPLICATION.

Connect a piece of coax in place of the DUT (in parallel). Tune across the spectrum for a notch in the response curve. An open 1/4 wave line reflects a short, acting as a trap at the notch frequency. Clip 1/4" lengths from the open end with different values of resistance and watch the notch move up in frequency. Terminate in different values of resistance until the notch disappears. The value of resistance represents the characteristic impedance of the line at that frequency. Connect the transmission line from your antenna in its place. You may be in for a surprise! The SW-5900 Tracking Generator is NOT a kit. It is a fully assembled and tested module, ready to be installed. Best of all, it is priced at $50 and is available from stock!

NEW!!! CENTER FREQUENCY READ-OUT CIRCUIT KIT FOR THE "POOR MAN'S SPECTRUM ANALYZER"

This new kit uses a unique combination of Analog and Digital circuitry to accomplish a relatively complex task. The conventional approach to this problem has always been purely digital, requiring anywhere from 10 to 20 digital chips. In keeping with the philosophy demonstrated by the design of the "Poor Man's Spectrum Analyzer", I felt that there had to be a simpler, more economical way. Since we are looking at a CRT display, covering anywhere from a few Mhz to several hundred, all we needed was a 3-digit read-out that could display 0 to 500 MHz directly.

PREVIOUS SOLUTIONS.

Most frequency read-out circuits use the local oscillator signal to generate the display. This signal is offset from the incoming RF signal by an amount equal to the IF frequency. A little arithmetic must be performed to either add or subtract the IF signal to get back to the received frequency. This has required the use of hetrodyne oscillators, pre-setable counters, or to somehow play games with the time base to accomplish the same result. These methods provide a relatively inflexible solution.

A NEW APPROACH.

Rather than using the conventional all digital circuit, I decided to use a Precision Frequency-to-Voltage converter IC, along with the output of the prescaler IC in the SW-5800 tuner. A bit of Analog Computer circuitry took care of the remaining math. Although this circuit was designed to work with the SW-5800 tuner, it provides experimenters with a simple low-cost solution for directly displaying the received frequency of almost ANY receiver. A simple adjustment of a potentiometer is all that is required to accommodate any IF frequency from 0 to hundreds of MHz. For the first time, a TRULY UNIVERSAL DIRECT DIGITAL FREQUENCY READOUT!

DISPLAY OPTIONS.

To keep costs down, I designed the circuit so that it could use your Digital Voltmeter as the display. With the meter set on the 20 volt scale, 0 to 500 MHz would be displayed as 0.00 to 5.00 volts. At first I found the decimal point annoying, but it didn't take too long before I was ignoring it. Later, when I found time, I bought a $29 DVM, disa-

bled the decimal point and dedicated that meter display to my Spectrum Analyzer. Now it reads directly in Mhz. However, we now have 2 miniature digital panel meter modules available that are ideal for this application. They measure approximately 1" x 2" x .5" and easily mount into a rectangular front panel cut-out. They are state-of-the-art, surface mount technology assemblies either LCD or LED. These are not kits. The LCD version sells for $59, the lED version is $3 more. We also have an LET version KIT that is slightly larger for only $39.

OTHER APPLICATIONS
FOR THE SW-6007.

There should be many other "frequency meter" applications for this unique circuit. Since this circuit could be used with ANY I.F., it represents a real breakthrough. Adjusting the I.F. offset with the simple setting of a single control has been unheard of until now!

PC BOARD.

The SW-6007 Kit is built up on a double-sided epoxy glass board, approximately 2" X 4.5", screened with the component parts layout. All parts and instructions are supplied. As usual, NO test equipment is required!

PRICE.

Best of all, it is priced in the tradition of the "Poor Man's Spectrum Analyzer", GUARANTEED NOT TO MAKE YOU POOR! Only $39 + $4 S/H. Available from stock!

OPTIONAL FILTER KIT FK-1001
SPECIAL PURCHASE!

The 2 ceramic filters supplied with the SW6006 main board kit are approximately 200 Khz wide. These filters are quite adequate for most applications. However, there are times when it would be desireable to be able to separate signals that are closer than 200 Khz apart. Ideally, we would like to be able to conveniently switch between narrow and wide band filters. The present board design is not set up to accommodate more than one set of filters at a time. The FK-1001 filter kit provides you with the opportunity to experiment with a narrower IF bandwidth. It contains one 15 Khz crystal filter and two matching tuneable transformers. Installing the 15 Khz crystal filter is a bit more difficult than the 2 ceramic filters. The mechanical configuration is completely different. Fortunately, there is enough space on the SW-6006 main board after the crystal filters and related components are removed. The 2 coils and the crystal filter can be mounted on a 5/16" x 1" piece of perf board. Two input and two output leads, plus a ground lead are then dropped down through the holes on the main board that were used for the 200 Khz filters and then soldered. You may have seen this arrangement at our display at a hamfest.

These filters were purchased as a one-shot-deal. I have not been able to locate a source that would allow me to make them available at a low price on a continuing basis. So while they last they are $25 for the kit. Order part # FK1001.

Murray Barlowe WA2PZO
TEL. 516 731 7628

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A Spectrum Analyzer consisists of a Basic Kit, & your choice of one or more tuners which determine the frequency ranges to be covered.

Description	Quan	Price	Total
BASIC KIT(Main & Ramp Boards) SW-6006K (Main Board Kit) or SW-6006W (Main Board Wired) SW-6001K (Ramp Board Kit) or SW-6001W (Ramp Board Wired)		 30.00 50.00 20.00 30.00	
TUNERS: a.) 0-500 Mhz (Modified cable tuner, w/prescaler)..SW-5800 b.) 420-900 Mhz (UHF ONLY tuner).....SW-5810		 35.00 15.00	
TRACKING GENERATOR SW-5900		50.00	
DIGITAL FREQ.READOUT KIT SW-6007K or, same as above, WIRED SW-6007W		39.00 59.00	
LCD DIGITAL DISPLAY, WIRED LCDDVM LED DIGITAL DISPLAY, WIRED LEDDVM LED DIGITAL DISPLAY, KIT LEDKIT		59.00 62.00 39.00	
UPS Shipping & Handling*			4.00
NYS Residents add Sales Tax			
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How did you learn of us?

UNDERSTANDING FM SIDEBANDS

WARNER W. JOHNSTON

New York, NY... For those who are not mathematically inclined, I do attempt to explain the purpose of the Bessel Null as used by the broadcaster so that you may follow discussions of use.

You may remember from AM that all information is contained in the upper and lower sidebands. In fact, the amplitude of the carrier does not change.

The information in the upper sideband is the same as that in the lower, and (assuming a distortionless system) only two sidebands exist. In fact, either of the sidebands and/or the carrier may be suppressed.

Equation 5A is a minor but quite justifiable variation on a basic equation of FM, which I will use for this tutorial.

In Equation 5A, the instantaneous voltage e_c is dependent upon the sine of the sum of two quantities. One of these quantities is the carrier frequency and the other is the modulating information, itself a sine wave for our purposes.

While I will not show proof here, Equation 5A may be rewritten in a different and more complex form (Equation 9), which is yet very useful.

A Useful Equation

As can be seen at once, this equation now consists of an indefinite number of terms, each of which is multiplied by some factor J_x.

Except for the first term (corresponding to J_0), each term consists of two sinusoid, one with a frequency below the carrier (X_c), the other with a frequency the same amount above the carrier. (See Fig.)

These two frequencies differ from the carrier by an integer multiple of the modulating frequency, and the integer corresponds to the subscript associated with J. Thus all the terms (except for the J_0th) exactly describe the frequency of a pair of sidebands.

The amplitude of the upper sideband and the lower sideband is identical (although possibly opposite in sign) and dependent upon the Bessel Function $J_x(m)$.

The first term, the J_0th term, contains only one frequency component, which happens to be the carrier frequency. Again, the amplitude of this component, the carrier, is dependent only upon the Bessel Function $J_0(m)$.

Thus we have a complete description of a sinusoidal carrier, which is frequency modulated by a sinusoid of lower frequency. We can write an exact value for each single sideband and the carrier once we can describe m, which we know to be the modulation index, and $J_x(m)$, which we know nothing about.

Bessel Functions

Friedrich Wilhelm Bessel (1784-1846) was an early 19th century astronomer and mathematician who was largely self-strained. His doctorate was awarded for work already done, not as a result of university training.

In addition to devising the form of analysis involving the Bessel Functions, he was also the first person to measure the distance of a star by the method of parallax, and also predicated the dark companions of Sirius and Proclon.

The Bessel Function (specifically the Bessel Function of the First Kind) is usually written in the notation $J_x(m)$, where the subscript x designates the order of the Bessel Function, and m is the variable (see Fig.)

As with a sinusoidal function, values of Bessel Functions can be found in tables in standard mathematical reference works. Because of their use in FM broadcasting, these tables are often found in broadcasting handbooks as well. Reference Data for Radio Engineers from Howard W. Sams is one example; it contains values for Bessel Functions of the first five orders.

Figure 1 is a graph of the Bessel Functions of orders zero through five for values of m less than 25. Figure 2 is the same for orders six through 15.

While a Bessel Function of any order (for broadcasting purposes, the order of Bessel Functions is limited to positive integers) can be calculated, it is unlikely that sidebands beyond the 15th need to be calculated. However, do remember that a 50 Hz signal can have up to 1500 sidebands in a standard FM signal.

Equation 6 and its minor variant Equation 6A relate the modulation index (m), the modulating frequency ( ) and the frequency deviation ( ). We also know, by regulation, that the maximum frequency deviation is 75 kHz, in the FM band.

If we examine the graph of the Bessel Function of the 0th order {Jo(m)}, we find that there are many values of m where the Bessel Function has a value of 0: m = 2.4048, m = 5.5201, m = 8.6537 are only the first three values.

If we frequency modulate our carrier with a sinusoid of an amplitude such that the modulation index is equal to one of these values (m = 8.6537 as an example), then the value of the Bessel Function $J_0(8.6537) = 0.00$.

In another fashion, with a modulation index of 8.6537 the amplitude of the carrier will be 0.00. Furthermore, from Equation 6 we can relate the modulation index, the modulating frequency and the frequency deviation: We find that with a modulation index of 8.6537, we need a modulating frequency of 8666 Hz to achieve a frequency deviation of 75 kHz (8.6537 X 8666 = 75,000).

We know, directly, by the equations of the FM system that we can determine frequency deviation. Figure 3 shows an FM system being modulated with 8666 Hz at some modulation index other than 8.6537.

The carrier frequency components can be seen in the figure. As the modulation index is changed to the third Bessel Null level of 8.6537, the amplitude of the carrier has changed to 0 (Figure 4). It can also be seen that the frequency deviation is 75 kHz.

This particular frequency and modulation index combination are of course not the only ones which can be used for setting frequency deviation. The second carrier null $J_0(5.5201)$ will cause 75 kHz devi-

FM SIDEBANDS

ation at a frequency of 13,587 Hz.

It is also possible to null one of the sidebands. Again, choose the modulation index where that particular Bessel function (of the same order as the sideband number) is qual to 0.

A second example of the use of the Bessel Null method with more application for television follows.

C-band satellite television transmission calls for audio frequency division of 185 kHz (370 kHz peak-to-peak). In choosing a frequency, you should take into consideration the maximum audio frequency usable by the system.

Since in television the maximum audio frequency is 15 kHz, we should stay well away from this and not exceed 14 kHz for most testing. Taking this into consideration we find that the lowest frequency we can use is 12.413 kHz at the 5th Carrier Bessel Null $J_0(14.903)$.

This null is shown in Figure 5.

It should be pointed out that adjusting deviation using the Bessel Null technique requires an accurate, stable oscillator which can be adjusted in steps of not more than 0.05 dB (0.01 dB is better), and has the ability to generate a signal at a level below -80 dBm.

When making a Bessel Null adjustment, be very careful counting nulls. It is very easy to skip one.

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Equation 5.

$$e_c = A\cos(\omega_c t + m\sin\psi t)$$

Equation 5A.

$$e_c = A\sin(\omega_c t + m\sin\psi t)$$

Equation 6.

$$m = \Delta\omega/\psi$$

Equation 6A.

$$m\psi = \Delta\omega$$

Equation 9.

$$e_c = A\{[J_0(m)\sin\psi t] + J_1(m)[\cos(\omega_c - 1\psi)t - \cos(\omega_c + 1\psi)t] + J_2(m)[\sin(\omega_c - 2\psi)t + \sin(\omega_c + 2\psi)t] + J_3(m)[\cos(\omega_c - 3\psi)t - \cos(\omega_c + 3\psi)t] + \ldots\}$$

Figure 1.

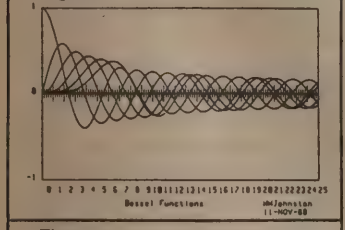


Figure 2.

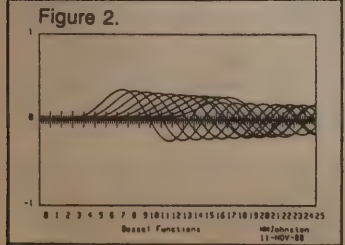


Figure 3.

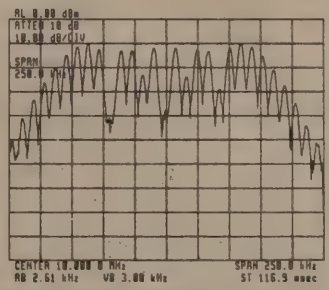


Figure 4.

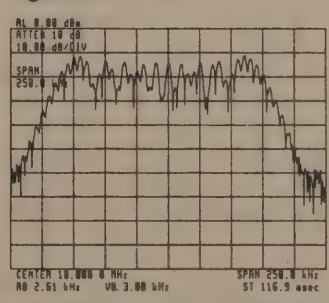
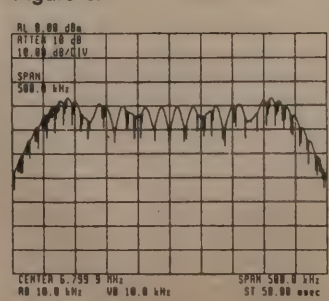


Figure 5.



A LIMITER FOR FM-TV

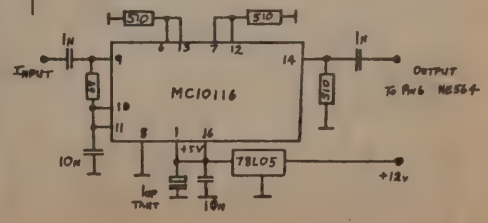
KLAUS HIRSCHELMAN DJ7OO

This article first appeared in TV-Amateur 62/1986 and we thank the editors for their permission to reproduce it here.

The phase-lock-loop integrated circuit type NE564N, which is used extensively by amateurs for the demodulation of FM ATV signals, is easily over driven by strong input signals. Although a limiting arrangement is built into the device, frequency rejections and signal distortions can still occur. To remedy this problem it must be ensured that the input level of the NE564 is not too high. This can be accomplished by using external signal limiters, and for this the Motorola MC10116 device is very suitable.

The MC 10116 line receiver is used in this application as a limiting broad-band amplifier, with approximately 20dB of IF gain, it delivers a stable output of approximately 0.8 volts. The circuit of this simple unit is shown in Fig. 1 and can easily be assembled using a small piece of Vero-board. The connection between the output of the last IF amplifier and the input to the NE564 on the demodulator is broken and the circuit inserted. The input and output connections to the limiter must be as short as possible. Power requirements for this modification are provided by the 78L05 regulator shown in the circuit, which is fed from the supply to the demodulator.

This improvement for the NE564 demodulator can be carried out easily and quickly, and is non-critical, in that no further adjustments to the system need be made. It leads to a noted improvement of the receive qualities and should therefore be part of any such equipment. (see Fig.) from BATC-CQ-TV with permission.



THE MICROWAVE OVEN FM ATV 250 WATT 2.4 GHZ TRANSMITTER

a review by Bill Parker W8DMR
with editorial comment by Henry KB9FO

At the Indianapolis ATV meeting in January, Dave Pacholok* KA9BYI from Sleepy Hollow, IL demonstrated and spoke about a microwave oven he had converted to an FM ATV transmitter for 2.4 Ghz with a power output of 250 watts! The project had been done in an effort to win an award from another publication. In our last issue we told ATVQ readers about the project from material we received prior to the demonstration. This article is based upon the presentation by Dave at the Indiana UHF-ATV meeting, from hand out material with some added comments and considerations by Bill Parker W8DMR. The builder may find numerous ways to modify and improve on the design and we would appreciate any reader/builder feedback.

Tom O'Hara W6ORG who is chairing the Dayton ATV forum has in formed us that Dave will bring the unusual transmitter to the Dayton Hamvention and speak at the forum.

The lure of high power at low cost for this band is great. However, before starting this project bear in mind that serious precautions need to be taken so that you and others are not injured. A microwave oven is designed to cook food. If the RF is loose in your ham shack it can cook YOU.

WARNING WARNING WARNING

DO NOT UNDERTAKE THIS PROJECT WITHOUT TAKING PRECAUTIONS. HIGH POWER MICROWAVE ENERGY CAN DAMAGE ANY LIVING TISSUE AND EVEN KILL. BE SURE TO ALWAYS HAVE A MICROWAVE OVEN LEAKAGE DETECTOR ON WHEN WORKING ON THE OVEN. NEVER APPLY POWER WITH SHIELD PLATES AND CABINET OFF. DO NOT WEAR CONTACT LENSES WHILE OPERATING. NEVER POINT THE ANTENNA AT ANY PERSON OR ANIMAL. REGULAR COAX CABLE CANNOT BE USED FOR THIS PROJECT. HIGH POWER AT THESE FREQUENCIES REQUIRES THE USE OF SPECIAL SILVER PLATE COAX AND TEFLON INSULATION. REGULAR COAX WILL MELT AND LEAK RF. DO NOT BYPASS ANY SAFETY FEATURES. DO NOT DEVIATE FROM THE RF DESIGN UNLESS YOU ARE EXPERT IN MICROWAVE AND HIGH POWER RF. THIS PROJECT CAN BE DANGEROUS AND SHOULD NOT BE UNDERTAKEN BY A NEOPHYTE IN HIGH POWER MICROWAVE. TURN OFF ALL POWER IF YOU FEEL ANY WARMING OF BODY PARTS. NEVER LOOK INTO WAVE GUIDE OR STAND IN FRONT OF THE ANTENNA WHEN OPERATING. FAILURE TO HEED THESE WARNINGS MAY RESULT IN INJURY OR DEATH.

Review by Bill Parker

GENERAL DESCRIPTION

A new microwave oven can be purchased for about $45 to $65. Typically a 450 watt oven delivers about 250 watts of RF at a frequency of 2450 Mhz. A video modulator must be added and some power supply changes made. The estimated cost of adding these components is less than $225. Many of the parts are available at Radio Shack and hamfests. To receive 23cm MDS (Multi-point distribution system) down-converters can be utilized with good results and at a very reasonable cost. The cost of many units advertised in major electronics magazines is usually $89 to $149. The MDS units include a 20 inch dish antenna with about 40 db gain (includes preamp gain). The down-converter tunes roughly 1.9 to 2.7 Ghz remotely from its base power supply.

A microwave oven magnetron is a self contained cross field power oscillator. Built-in cavities primarily determine the oscillator frequency. However, the amount of plate voltage and strength of the magnetic field around the magnetron does determine the quiescent operating frequency. By experiment and analysis the best operating mode is FM video.

Ed. Comment: The oscillator is a basic tank circuit, as with any oscillator connected to a load, the load acts as a "tap" across part of the tank circuit, thus affecting the resonant frequency. In the case of this project the external circuit is tuned by placement of the wave guide to coax probe and by the impedance and reactance of the load. A frequency counter must be used to measure the output frequency of the unit when in use to avoid out-of-band operation. WARNING: The CIA operates satellite spy video on adjacent frequencies and they take a very DIM VIEW of your operating on THEIR frequencies!. END

Experimental tests by Dave indicate that a maximum useable frequency swing is about 20 Mhz. The coefficient of frequency change is about .1 Mhz/ma of Magnetron current.

The video modulator is a bit unusual as shown in the block diagram. It functions as a high voltage current source of high open-loop gain that can set the magnetron current to a known value. This establishes the operating frequency and power output.

The unit of transconductance is the Siemen (formerly MHOS). Transconductance is the reciprocal of resistance. For volts in, the modulator provides a current out. It is essentially Ohm's law inverted or upside down. MHOS= current/voltage. The video modulator has a transconductance of 0.2 Siemens.

The transconductance amplifier must provide enough bandwidth to amplify all the video modulation components. If an audio subcarrier is used the bandwidth requirement is 6 Mhz. A capacitor and resistor (C6, R27) is used to extend the high frequency response from approximately 4.5 to 6.0 Mhz. A video pre-emphasis circuit is still required for FM usage.

ED NOTE: see the ARRL Handbook, FM Video, CCIR video pre-emphasis network

by Bruce Brown W9GVW. END.

The screen supply for the two sweep tubes must float above ground. Only the Magnetron plate current must be allowed to enter the current source control loop as the controlled variable. The screen current should not be included.

The wave guide must be modified by adding a shorting partition or plate. This is analogous to a 1/2 wave coaxial stub or a 1/4 wave when reflected path provides twice the distance. Wave fronts in either case, are phase shifted by 180 degrees. The shorting plate causes the reflected wave to be in phase with the incident wave from the magnetron. The E field probe is inserted where the RF voltage maximum occurs.

Normally the length of an output probe is 1/4 wave for maximum power output. Shorting the output probe introduces a reactive component to the output port of the magnetron. After undetermined number of degrees of rotation within the magnetron feed structure back to the magnetron cavities causes the operating frequency to be lowered by about 25Mhz. This helps insure operation in the legal amateur 23 cm band.

CIRCUIT DESCRIPTION

The +5 volt regulator, U2 provides a voltage reference. It is divided by R5 and R6 and connected to the non inverting input of wide band op-amp U1 establishing a current reference. The output of U1 feeds the gate of Q1.

The output of the source follower Q1 is sent to R9 and through R7 providing negative feedback to the inverting input of U1. THe feedback ratio is calculated as follows:

$$\text{FEEDBACK RATIO} = \frac{R9+R7}{R7} =$$

$$\frac{470 + 100}{100} = \frac{570}{100} = 5.7$$

At equilibrium, Q1's drain to source current produces a drop across R 11 that is 5.7 times U1's non inverting input voltage. Pot R6 sets a drain current in Q11 that is proportional to the non-inverting input of U1. The plate and cathode current of V1 and V2 in parallel are one in the same if screen current is not considered at this time.

The voltage on the drain of Q11 increases or decreases until the control grid of V1, V2 changes the cathode bias until Ik = Id = Is. V1 and V2 are a grounded grid voltage amplifier with unity current gain. V1 and V2 have sufficient current capacity to serve as a current source for the magnetron.

Actually a transconductance amplifier is formed with the high value of 220,000 microsiemens (0.2 Siemens). The value can be calculated by solving:

$$S = I/V = \left(\frac{R9 + R7}{R7}\right) \times$$

$$\left(\frac{1}{R11} + \frac{1}{R9 + R7}\right) = .22\ S$$

Transformer T3 provides a non-grounded +100 V screen supply for V1, V2. R 28 limits the screen dissipation. The screen floats above ground because only the plate current (Ik = Im) should enter the control loop by way of V1 and V2 cathode and is the control parameter (less the screen current).

Components R 14 and R15 help provide current sharing in V1, V2. Zener diode D3 protects power FET Q1. Resistors R16-R27 serve as voltage equalizing as well as bleeders for the supply.

Regulators U3 and U4 provide +15 and -15 V for the op-amp. Magnetron current is monitored by meter M1.

CONSTRUCTION DETAILS

Depending on the exact brand and model microwave that is to be modified certain general information applies.

First, inside the oven, cut off the wave guide that connects to the cooking cavity matching flange.

Second, a wave guide shorting cover needs to be fabricated to cover the feed port to the oven chamber. The size of this port is typically about 1.5 inches by 3.5 inches. A piece of COPPER approximately 3 x 5 inches, 18-22 gauge will do nicely. Drill 16 to 22 holes around the outer edge for mounting holes. Of course, an equal number of holes will need to be drilled around the oven wave guide port. Sheet metal screws or machine screws with nuts will provide a good shorting partition for the open wave guide end.

Third, an E-field probe needs to be constructed. Using a TEFLON N connector solder apiece of about 0.175 diameter 5/8" long brass tubing to the connector,. Solder a brass nut to the other end of the brass tubing. Insert a 1/2 inch brass screw into the nut. This forms a tuning adjustment for the probe. Have the screw fully inserted and snug tight.

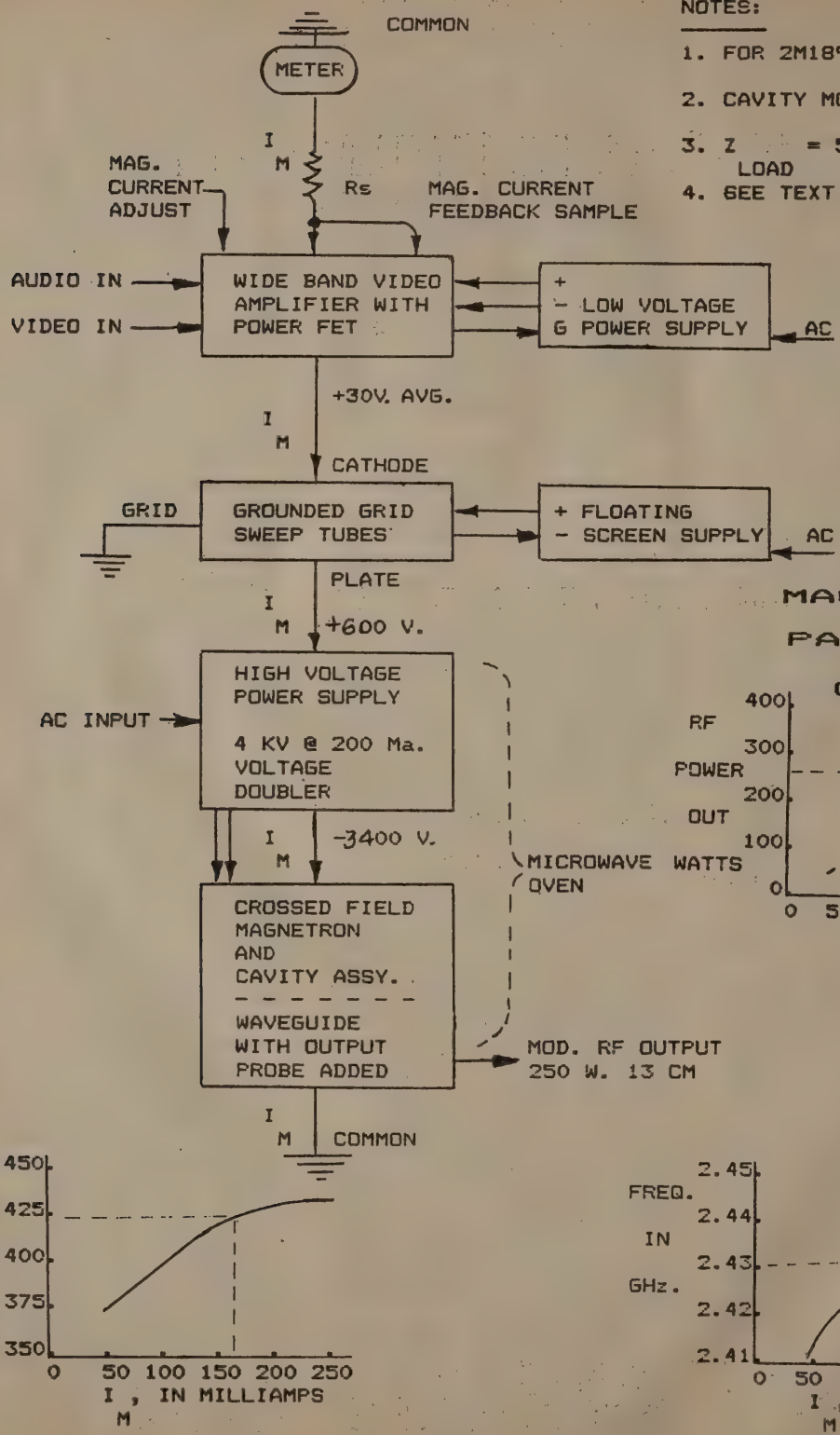
Fourth, a hole must be made in the wave guide to accept the probe. The hole is placed in the op of the wave guide from the outside of the oven. It mounts 1 and 5/16th inch from where the wave guide cavity shorting partition was added. It should also be centered in the wave guide.

Fifth, the filament leads of the magnetron are bypassed by feedthrough capacitors. The ground side of each feedthrough capacitor must be opened. Care must be taken not to damage the insulation on the filament wiring. The capacitors are white oval shaped ceramic. By drilling out four rivets the ground is removed. The capacitors are about 2000 pf. Push the capacitors back into the tube housing about 1/8" or so, so that the ground is broken and it will not slip back when in use.

Sixth, inside the microwave oven cooking chamber it is necessary to remove the radome (food splatter cover). Remove the dielectric RF energy dispersal unit (stirrer) also. Next remove the feed guide to the multimode cavity Z-matching plate is removed. The matching plate is removed by cutting or sawing. The magnetron cooling air is discharged into the oven chamber. If the video modulator tubes are mounted inside the chamber they too are cooled.

Retention of the oven door and interlock switches provide a safe way to disable the high voltage

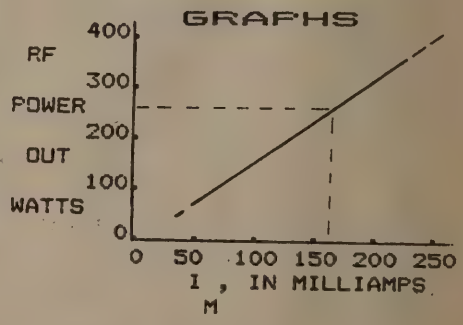
BLOCK DIAG. — MICROWAVE ATV XMTR

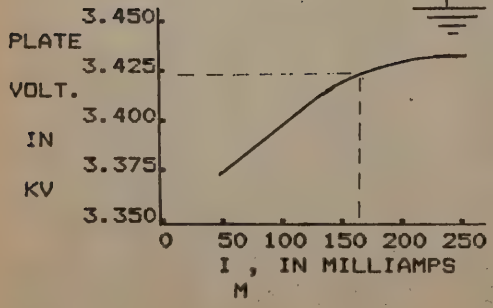


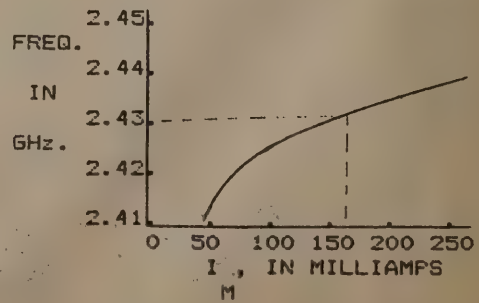
NOTES:

1. FOR 2M189A MAGNETRON.
2. CAVITY MODIFIED W/SHORT.
3. Z LOAD = 50 + J0
4. SEE TEXT FOR SHORT INFO.

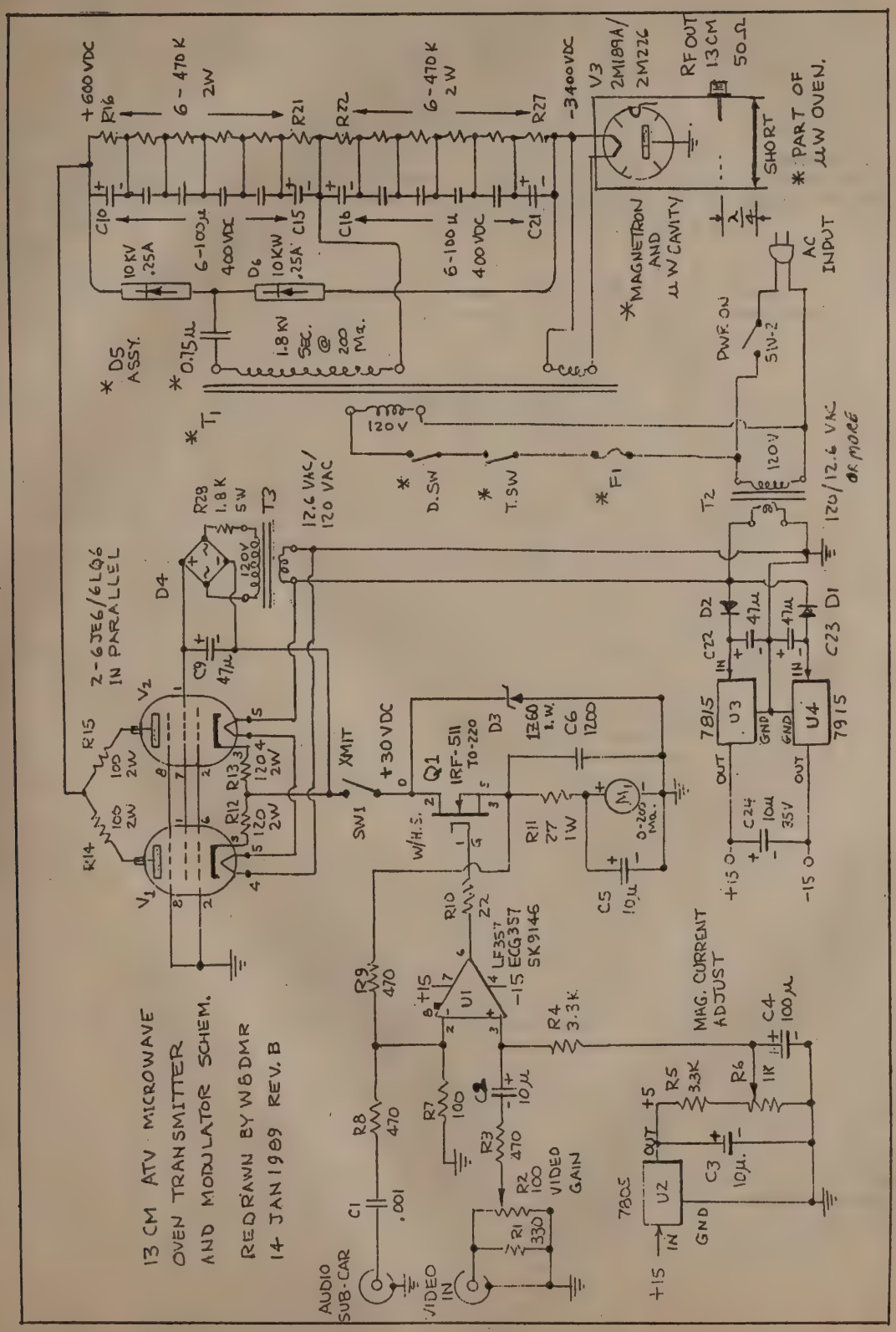
MAGNETRON PARAMETER GRAPHS







SCHEM. DIAG. — MICROWAVE ATV XMTR



whenever the oven door is opened. The outer cabinet cover further increases safety and is drilled to accept and allow the output N connector to exit when the cover is later reinstalled.

SAFETY Precautions

Radiant energy above a certain level can be harmful. Use an inexpensive microwave leakage detector to verify the safety of the finished transmitter. Readings from any surface of the transmitter in the unsafe or red some indicate a leak that MUST be corrected.

Do not point a microwave antenna emitting RF power levels in the class of this transmitter at people, buildings, residential areas. use common sense and don't test it on your pets. Currently a level of more than 5 milliwatts per square centimeter at 2400 Mhz is considered hazardous.

REFERENCES:

A photo copy package of 40 or so pages with multiple photos and notes is avaiable for $6 from:

1.* Dave Pacholok KA9BYI
Creative Electronics
1815 W. Higgins Rd.
Sleepy Hollow, IL 60118
312 428 5676

2. RF Deisgn Magazine, Design Award, Dave Pacholok, Pages 24,25, July 1988.

3. Microwave Oven ATV Transmitter D. Pacholok, Indiana UHF and ATV Meeting, 14 Jan 1989.

PARTS LIST — M.O. ATV XMTR

ITEM	QTY.	DESCRIPTION	EST. COST
1.	1 EA.	MICROWAVE OVEN, 400-500 WATT WITH 2M189A OR 2M226A MAGNETRON	$ 70.00
2.	2 EA.	TV SWEEP TUBE, 6JE6C/6LQ6C	$ 24.00
3.	12 EA.	CAPACITOR, ELECTROLYTIC, 100 MFD/400V	$ 36.00
4.	1 EA.	DIODE, HI. V. RECTIFIER, 10 KV, 250 MA.	$ 12.50
5.	12 EA.	RESISTORS, 470 K OHMS, 1 OR 2 WATT	$ 6.00
6.	1 EA.	TRANSFORMER, 12.6 VAC, 3.0 AMPS.	$ 8.00
7.	1 EA.	TRANSFORMER, 12.6 VAC, 450 MA.	$ 4.00
8.	1 EA.	METER, 0-200 MA. USED OR SURPLUS	$ 5.00
9.	1 EA.	CONNECTOR, N-TYPE, FEMALE, CHASSIS MNT.	$ 3.00
10.	2 EA.	CONNECTOR, F-TYPE, FEMALE, CHASSIS MNT.	$ .50
11.	1 EA.	IC, LF357, WIDE BAND OP-AMP	$ 3.00
12.	1 EA.	IC, REGULATOR, 7815	$ 1.00
13.	1 EA.	IC, REGULATOR, 7915	$ 1.50
14.	1 EA.	IC, REGULATOR, 7805	$ 1.00
15.	1 EA.	TRANSISTOR, POWER FET, IRF-511	$ 2.00
16.	2 EA.	DOIDE, LOW V. RECTIFIER, 200 V., 1 AMP.	$ 1.00
17.	1 EA.	DIODE, BRIDGE ASSY., 400 V., 1 AMP.	$ 2.00
18.	1 EA.	DIODE, ZENER, 68 VOLT, 1 WATT	$ 2.00
19.	1 EA.	CAPACITOR, CERAMIC, 0.001 MFD.	$ .50
20.	1 EA.	CAPACITOR, ELECTRO., 10 MFD., 25 VOLT	$ .50
21.	2 EA.	CAPACITOR, ELECTRO., 100 MFD., 10 VOLT	$ 1.00
22.	1 EA.	CAPACITOR, ELECTRO., 330 MFD., 10 VOLT	$ .50
23.	1 EA.	CAPACITOR, POLY., 1200 PFD., 100 VOLT	$ .50
24.	1 EA.	CAPACITOR, CERAMIC, 0.1 MFD., 50 VOLT	$ .50
25.	2 EA.	CAPACITOR, ELECTRO., 47 MFD., 160 VOLT	$ 1.50
26.	2 EA.	CAPACITOR, ELECTRO., 470 MFD., 25 VOLTS	$ 2.00
27.	1 EA.	RESISTOR, 390 OHM, 1/4 WATT	$ .10
28.	1 EA.	RESISTOR, 100 OHM, VARIABLE, PANEL MOUNT	$ 2.00
29.	3 EA.	RESISTOR, 470 OHM, 1/4 WATT	$ .30
30.	2 EA.	RESISTOR, 3.3 K OHM, 1/4 WATT	$ .20
31.	1 EA.	RESISTOR, 1.0 K OHM, VARIABLE, PC BRD.	$ 1.00
32.	1 EA.	RESISTOR, 100 OHM, 1/4 WATT	$ .10
33.	1 EA.	RESISTOR, 22 OHM, 1/4 WATT, 5 %	$ .10
34.	1 EA.	RESISTOR, 27 OHM, 1.0 WATT, 5 %	$ .25
35.	2 EA.	RESISTOR, 120 OHM, 1.0 WATT, 5 %	$ .50
36.	2 EA.	RESISTOR, 100 OHM, 1.0 WATT, 5 %	$ .50
37.	2 EA.	RESISTOR, 470 OHM, 1.0 WATT, 5 %	$ .50
38.	1 EA.	SWITCH, POWER, 125 VAC, 0.5 AMP.	$ 2.00
		ESTIMATED TOTAL ≈	$198.55

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Park Ridge NJ 07656

VHF Communications
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516 Mill St. NE
Vienna VA 22180

EGE Bldg. B
14803 Build America Dr.
Woodbridge VA 22191

F&M Electronics
3520 Rockingham
Greensboro NC 27407

HRO
6071 Buford Hwy
Atlanta GA 30340

Doc's Communications
702 Chickamauga Ave.
Rossville GA 30741

AES
621 Commonwealth Ave.
Orlando FL 32803

AES
1898 Drew St.
Clearwater FL 33575

Radio Shack / Cotronics
2200 SE Federal Hgwy
Stuart FL 34994

Universal ARC
1280 Aida Dr.
Reynoldsburg OH 43068

Doug Hall Electronics
815 E. Hudson St.
Columbus OH 43211

AES
28940 Euclid Ave.
Wickliffe OH 44092

Ham Station
PO Box 6522
Evansville IN 47719

Michigan Radio Service
15000 Nine Mile Rd.
East Detroit MI 48021

AES
4828 W. Fond du Lac
Milwaukee WI 53216

Burghardt Amateur Ctr
182 N. Maple PO Box 73
Watertown SD 57201

C&S Sales
1245 Rosewood
Deerfield IL 60015

Erickson Communications
5456 N. Maiwaukee
Chicago IL 60630

Gateway Electronics
8123 Page Blvd.
St. Louis MO 63130

Missouri Radio Center
102 NW Business Park
Kansas City MO 64150

Associated Radio
8012 Conser Box 4327
Overland Park KA 66204

Inland Software
510 Oregon St.
Hiawatha KS 66434

Dandy's
124 S. Washington
Wellington KS 67152

Electronic Center Inc.
2809 Ross Ave.
Dallas TX 75201

Madison Elec. Supply
3621 Fannin
Houston TX 77004

Gateway Electronics
9890 Westoark Dr.
Houston TX 77063

Mission Communications
11903 Aleif Clodne #500
Houston TX 77082

Allied Appliance & Radio
4253 South Broadway
Englewood CO 80110

Gateway Electronics
5115 N. Federal #32
Denver CO 80221

Gateway Electronics
9222 Chesapeake Dr.
San Diego CA 80221

Colorado Comm Center
525 E 70th Av. Suite 1W
Denver CO 80229

Ross Distributing Co
78 S State St. POB 234
Preston ID 83263

HRO
1702 W. Camelback Rd.
Phoenix AZ 85015

AES
1072 N. Rancho Dr.
Las Vegas NV 89106

Henry Radio
2050 S. Bundy Dr.
Los Angeles CA 90025

Jun's Electronics
3919 Sepulveda Blvd.
Culver City CA 90230

HRO
6265 Sepulveda Blvd.
Van Nuys CA 91411

A-Tech Electronics
1033 Holywood Way
Burbank CA 91505

HRO
5375 Kearney Villa Rd.
San Diego CA 92123

HRO
2620 W. La Palma
Anaheim CA 92801

HRO
2210 Livingston St.
Oakland CA 94010

HRO
999 Howard Ave.
Burlingame CA 94010

Honolulu Electronics
819 Keeaumoku Ave.
Honolulu HI 96814

MoTron Electronics
695 W 21st Ave.
Eugene OR 97405

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"BLOOMING" VIDEO

LYN H. CYR, W1NRE

Some of the video transmitters in use display a "blooming" effect and the audio is distorted for the initial 1 or 2 seconds after first keying up the transmitter. Have no fear, the solution is near.

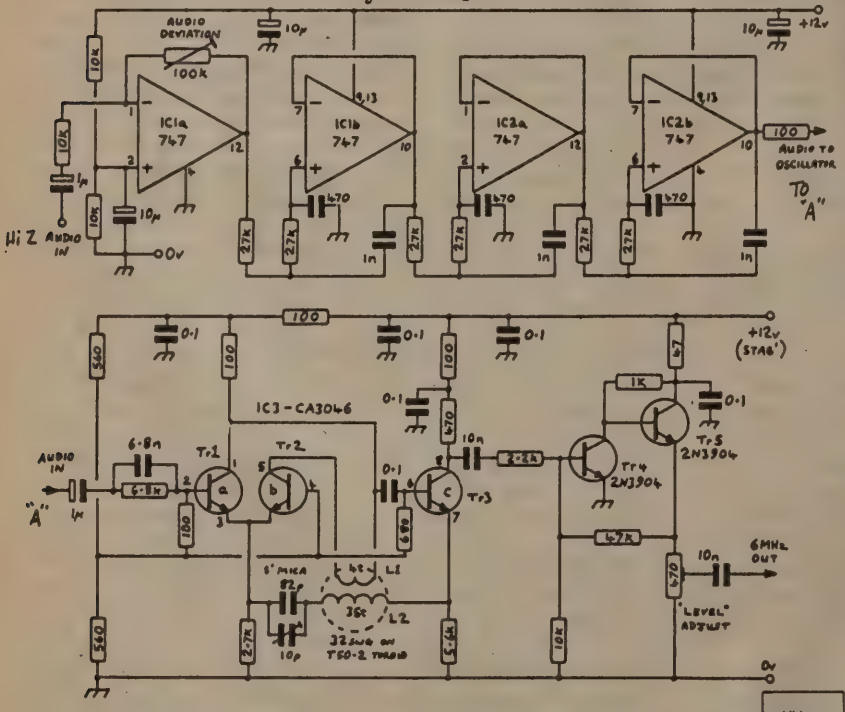
The solution lies in keying method and its effect on the video modulator circuit. A popular keying method in low power transmitters is to key the entire power supply voltage to the transmitter since the current drain isn't much. This is the culprit!

Upon examining the video modulator you will probably find a large coupling capacitor (about 100Mfd - C1) from the video gain control to the base of the first video amplifier (See fig.1). The value of capacitance at the input stage establishes the low frequency and is determined by the input impedance of the amplifier. The higher the input impedance of the stage, the lower the input capacitance can be to maintain good low frequency response. Since the capacitor can and will charge up through the biasing network, how soon the base voltage will stabilize will depend on the RC time constant of the network. When the transmitter has been off for some time the capacitor will have been discharged but upon application of power the cap will momentarily look like a short circuit and charge up to the bias voltage value provided by the resistive divider network (R1, R2). As the base voltage is increasing because of C1, the correct bias voltage will be upset as well as the blanking level. The result will be an in-correct video setup for that period of time.

The solution is simple. Key only the transmitter not the video modulator. With minor surgery find the line that feeds +VCC to your modulator and connect it to an unkeyed source. In this way when you key transmitter the modulator and hence the input coupling cap will have already been charged up putting the bias of the first stage into a stabilized operating point. Happy no "blooming" key ups.

FM-TX

by WB0ZJP



6 MHz SUBCARRIER GENERATOR

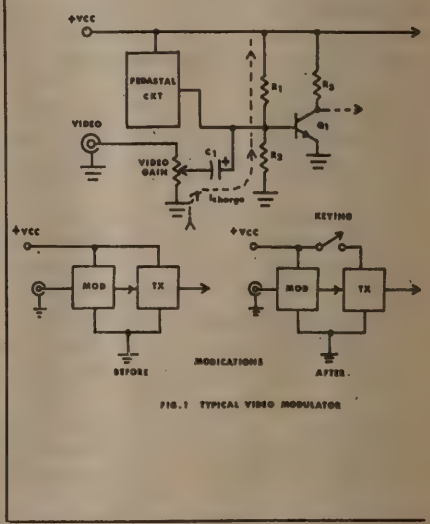
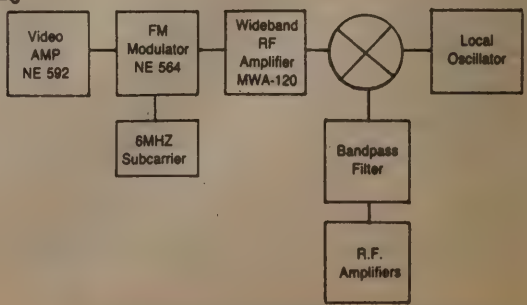


FIG.1 TYPICAL VIDEO MODULATOR



ATV INTERDIGITAL FILTERS

LYN H. CYR, W1NRE

Prior to the publication of "Computer Aided Interdigital Bandpass Filter Design" written by Jerry Hinshaw, N6JH, which appeared in the January issue of Ham Radio magazine, the subject of high performance filters was relegated to the professional publications. Wideband filters, which might have had ATV repeater applications, were constructional in nature and did not offer any choice of parameter modifications. Most of the previous designs were of the squared rod type and limited in the number of poles. Construction of these filters was simple enough but test results were a little disappointing. The bandwidths were either too narrow or broad and the insertion losses not too desirable. Out of frustration, the subject of filters was put on the back burner.

Thanks to Jerry and his excellent article, the hair pulling was over. The technical discussions which had appeared in the professional journals with their many formulas were now a thing of the past. Jerry had compiled an MS/DOS Basic program written for the IBM PC which was promptly translated to a Commodore C-64 format. We were now free to modify and try several designs without expending precious time and materials.

The original design goals of the filter were: 1. Minimum insertion loss, 2. Enough out of band isolation to permit duplexing, 3. Sufficient bandwidth to pass the video, color burst, and 4. 5Mhz sound subcarrier. The first filter was designed and built for a 5MHz bandwidth. Subsequent testing on a network analyzer was met with mixed emotions. While the response curve was close tot he computer's predicted results, the actual bandwidth was a little narrower than expected. We tend to speak of ATV bandwidths in terms of 4-5Mhz and I had overlooked the basic definition of the term which places the bandwidth at the -3db points. As a consequence, the color burst and sound subcarrier information was rolled off a bit too early. After trying several other software designs a 7 MHz bandwidth seemed to meet the requirements nicely. Several number of poles were also tried and the results of the response curve plotted in Figure 1. As might be expected from this graph, a 7-pole, 7Mhz wide filter was chosen because of its steeper skirts. Filters were calculated for 426.25Mhz and 439.25-Mhz and plotted on the same graph to determine the amount of isolation to be expected from the filters in a duplex configuration (see Fig. 2). As shown in the graph, the amount of isolation between the transmitter video carrier and the receiver video carrier is about 60 db. Since we were planning to use separate antennas and additional 30-40db of isolation could be expected. Taking into account the receiver's IF frequency response, filter response and antenna separation, over 120db of isolation could reasonably be expected. Everything seemed to fall into place and the construction of the filters was begun.

The final mechanical design dictated that a ground plane spacing of 2" with a rod diameter or 3/8" would meet all of our requirements. The sides of the filter were made out of 2x1/4" aluminum bar sock and 3/8" aluminum rod. The rods were available in most hardware stores which carry Reynolds Aluminum. The rods come in 6 foot sections. The 2x1/4" bar stock was a bit more troublesome to obtain as no one seemed to have any in stock or there was a minimum purchase requirement. Fortunately, a "little ole" sheet metal shop was willing to order a piece of bar stock for me if i was willing to have the 12 ft piece cut in half so that it could be shipped UPS thus saving trucking costs. The ground plane or covers were made of 1/16" aluminum sheet. Other than using a lathe to cut the ends of the rods square and mounting holes centered, the entire assembly was made with nothing more than a table saw with a metal cutting blade and a drill press. I have to thank Joe Adelizzi, former KN1AF0, for his extreme patience with my demands on accuracy and putting up with me. Joe is sort of our "mechanical wizard" with all of our club's repeater projects and without his support, many of our projects would have incurred heavy financial expenditures for mechanical work. The total cost of the materials was under $80.00 which was enough material to construct two filters.

The filter dimensions were those shown in Figure 3. The 910 and 1296 designs have not been tried but enough confidence can be had by the excellent results we had from the 450Mhz versions. The critical dimensions are the element lengths and their center-to-center spacing. The performance of these filters will be dependent on how closely the dimensions can be held. For a given mechanical design, changing frequency by more than 1Mhz or so may not be possible even though tuning screws are provided. The tuning screws allow for fine adjustments only. Particular attention should also be given to the tap distances on the outer elements. These dimensions are for 50 ohm terminations and deviations from these will alter the response of the filter.

Not all of the dimensions are given in the sketch of Fig. 4, as the cover sizes and location of mounting holes will be dependent on the frequency. The cover screws, however, should be located at the center line of the elements and more added if desired. A good ground contact between the covers and the side walls is essential.

The four sides were cut to size and assembled to ensure squareness as well as to provide a template from which the covers could be made. The sides were then taken apart and the two long pieces scribed to mark the element locations. The sides were clamped together and drilled at the same time to ensure alignment of the tuning screws with the element ends. The holes were first drilled for an 8-32 tap size and

then those holes securing the elements enlarged to an 8-32 clearance hole. Note that a tap hole must be opposite a clearance hole. The end pieces were treated in the same manner. The center hole for the connector should be the same distance from the inside wall as the 50 ohm tap distance. The mounting holes for the type N connector were tapped for 4-40 screws. The length of the screws securing the connector should not protrude into the enclosure. After the covers were cut to size they were also clamped to the enclosure where the mounting holes were drilled again to ensure alignment of the cover screw holes to the sidewall holes. Mount the end rods so that the tapped hole can be accessed from either the top or bottom side (see Detail A, Fig. 4). Using a piece of #12 AWG wire pass one end of the wire through the element hole so that it can be soldered to the center conductor of the connector. Once soldered in place tighten the recessed Allen head screw securely on the element and trim any excess exposure beyond the rod.

The filter is best aligned using a sweep generator or network analyzer, if you are fortunate enough to have access to one. Not having either, you could use a ATV transmitter with color bar or multiburst modulation. Using your off the air RF sampler adjust the filter for best response. One word of caution, however, most RF line samplers work fine when looking at your signals on TV monitor but the high frequency roll off can sometimes be excessive. (Good topic for another article).

While these filters are not intended to be true vestigial sideband filters they do reasonably well in that respect. As duplexers they have done remarkably well at the W1NRE ATV repeater with a transmitter power of 100 watts PEP.

I hope that the computer aided filter designs can offer you a solution to your repeater or duplexing problems and that they will provide the needed push to get that ATV repeater on the air.

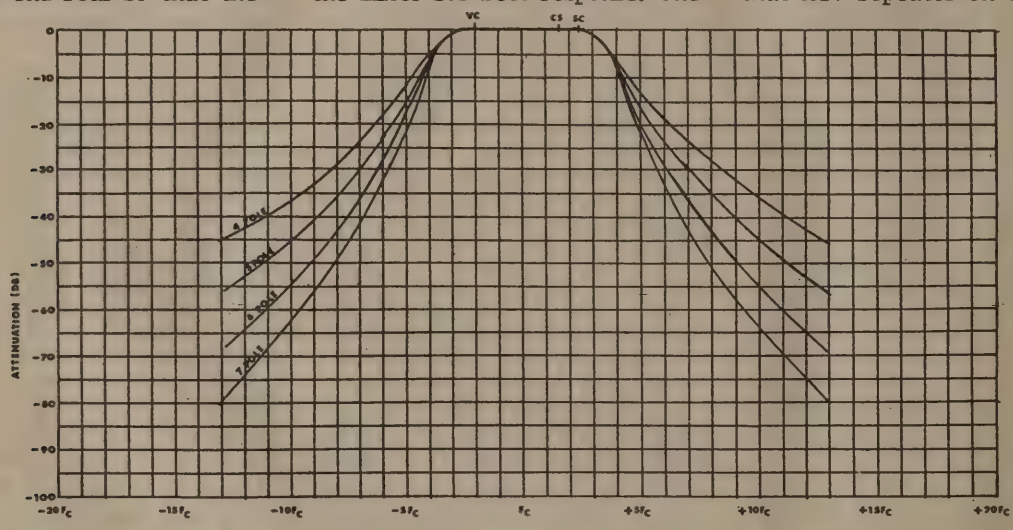


FIG. 1 FILTER RESPONSE VERSUS NUMBER OF POLES

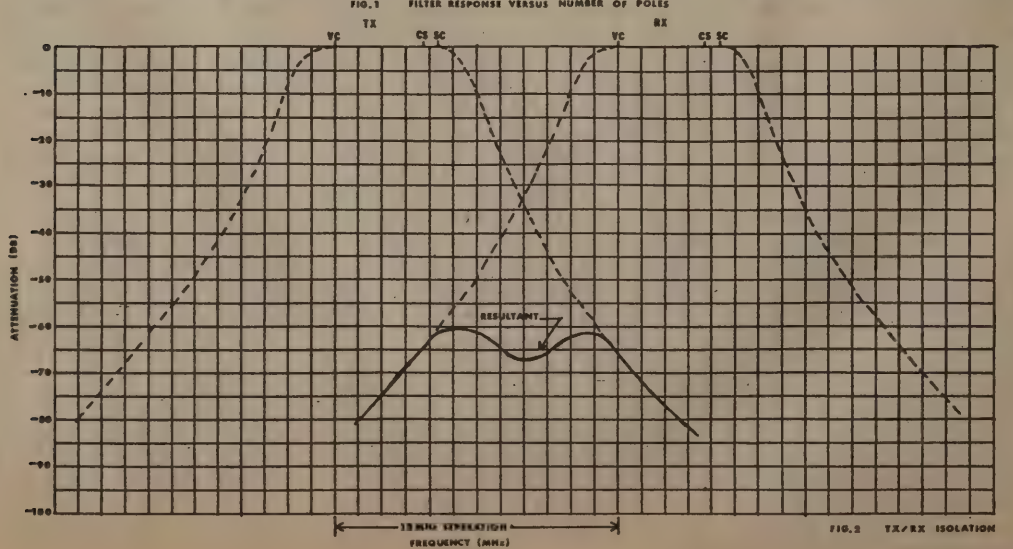


FIG. 2 TX/RX ISOLATION

ATV INTERDIGITAL FILTERS

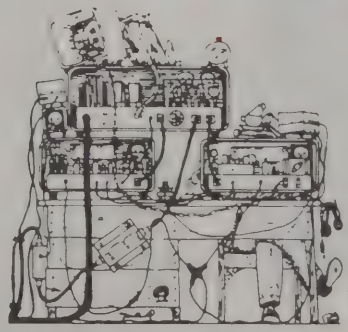
7-POLE ATV INTERDIGITAL FILTERS
****

CARRIER FREQ. (MHZ)	421.25	426.25	434.00	439.25	910.25	911.25	923.25	1241.25	1289.25
CENTER FREQ.	423.50	428.50	436.50	441.5	912.50	913.50	925.50	1243.50	1291.50
LOWER CUTOFF (-3DB)	420.00	425.00	433.00	438.00	909.00	910.00	922.00	1240.00	1288.00
UPPER CUTOFF (-3DB)	427.00	432.00	440.00	445.00	916.00	917.00	929.00	1247.00	1295.00
INSERTION LOSS (DB)	.824	.829	.837	.842	1.210	1.210	1.128	1.42	1.44
DIMENSIONS (INCHES)									
INSIDE HEIGHT	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
INSIDE LENGHT	18.543	18.587	18.658	18.702	21.475	21.470	21.529	22.657	22.801
INSIDE DEPTH	6.967	6.886	6.760	6.683	3.234	3.230	3.188	2.373	2.285
INSIDE ELEMENTS	6.539	6.458	6.331	6.254	2.815	2.812	2.770	1.962	1.874
END ELEMENTS	6.649	6.567	6.439	6.361	2.891	2.887	2.845	2.037	1.949
ROD DIAMETER	.375	.375	.375	.375	.375	.375	.375	.375	.375
TAP FROM GROUND END	.568	.558	.542	.533	.179	.179	.175	.113	.106
CENTER TO CENTER SPACING FROM INSIDE WALL (INCHES)									
WALL TO ELE. #1	.500	.500	.500	.500	.500	.500	.500	.500	.500
ELE. #1 TO ELE. #2	2.524	2.532	2.543	2.551	3.013	3.013	3.022	3.210	3.234
ELE. #2 TO ELE. #3	3.048	3.056	3.068	3.075	3.537	3.538	3.546	3.734	3.758
ELE. #3 TO ELE. #4	3.199	3.206	3.218	3.225	3.687	3.688	3.696	3.884	3.909
ELE. #4 TO ELE. #5	3.199	3.206	3.218	3.225	3.687	3.688	3.696	3.884	3.909
ELE. #5 TO ELE. #6	3.048	3.056	3.068	3.075	3.537	3.538	3.546	3.734	3.758
ELE. #6 TO ELE. #7	2.524	2.532	2.543	2.551	3.013	3.013	3.022	3.210	3.234
ELE. #7 TO OTHER WALL	.500	.500	.500	.500	.500	.500	.500	.500	.500

FIG. 3 FILTER DIMENSIONS

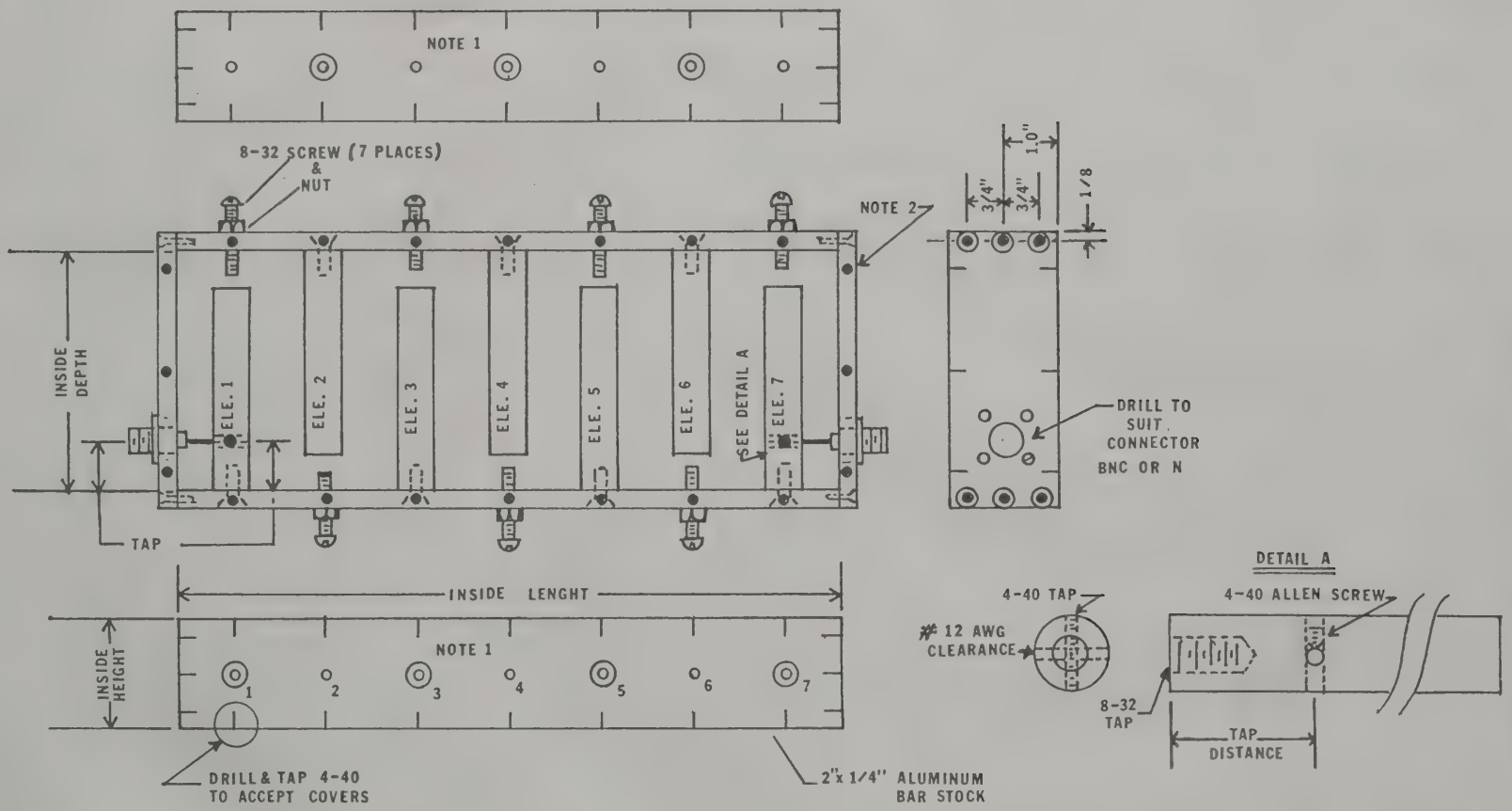
Balch Springs, Texas 75180

WTV



HAM ASSOCIATION OF MESQUITE

Andrew D. Carstarphen
12904 Elam Road, Apt. 402



NOTES:

1. ○ DRILL & TAP 8-32
   ◎ DRILL 8-32 CLEARANCE (COUNTERSINK OPTIONAL)
2. ● DRILL & TAP 4-40
   ◉ DRILL 4-40 CLEARANCE

DRAWN: Eyclop. 1/30/89

FIGURE 4. 7-POLE FILTER ASSEMBLY

LIVE TV CAMERA TAKEN TO EDGE OF SPACE

On Jan.21, 1989 a 7 foot Helium Balloon carrying a live TV camera was launched by Bill, WB8-ELK from Hesperia, CA in the Mojave Desert. The package consisted of a 100 mW 2M FM transmitter on 144.34 Mhz sending out a CW message and a P.C. Electronics KPA5 1 watt ATV transmitter on 434 Mhz. The video alternated between two computer L.D. screens on an Elktronics VDG-1 and a live TV camera pointing down at the earth below. Russ, W8VKR donated a miniature SONY B/W camera (model HVM-302) for this flight. This camera only weighs 6 ozs. and even has an auto iris and microphone. Two inch thick styrofoam was used for insulation which housed the electronics and the 7.5 Ah Lithium cells (SAFT LX3457). A two meter vertical ground plane antenna was mounted to the top of the package. Mike, WA6SVT built a 1/4 wave GP for 434 Mhz which dangled 4 feet below the package in order to keep RF away from the camera.

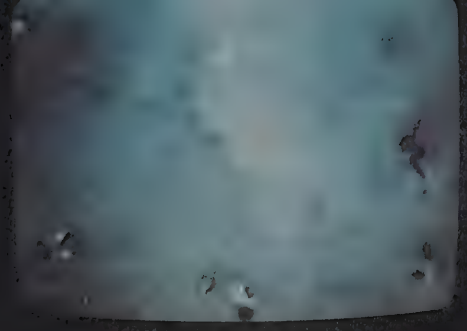
The balloon was launched from the parking lot of Mark Fischer's communications business (WB7AJC) at 9:48am. The camera video showed us all cheering and waving bon-voyage as the balloon headed up at over 850 feet/minute. Wes, WA6IPN, had set up a ground station so we could watch the spectacular views of the desert floor and the town of Hesperia. Dramamine is recommended when viewing the video tape as the package spun around once every few seconds! Future flights will have some form of stabilization to prevent spinning. Ernie, WB6BAP and Bob, N6AZV used telescopes to triangulate the balloon's position optically during the first few minutes. The picture of the balloon in flight was taken by Ernie through his telescope when it was over 10,000 feet high. At 20,000 feet the balloon went through a cloud layer and only the tops of the clouds could be seen for the rest of the flight. After nearly 2 hours the balloon achieved its maximum altitude of about 105,000 feet. At this point the ATV signal could be viewed all over southern California and was seen as far away as Phoenix, Arizona (300+ miles distance!) by KD7HH, KS8J, WV7K and others at nearly P5 levels. Since the package was now in a near vacuum the spinning had nearly stopped. A peaceful view of the clouds far below could be seen as the package slowly drifted back and forth. The ATV antenna could be seen hanging straight down. Suddenly the balloon burst, the antenna swung abruptly to one side and the package began its wild gyrating return to the desert floor below. As the package tumbled, twisted and spun it's way back we were all treated to views of the horizon which reminded us of Space Shuttle flights. Even though it was noon the blackness of space could be seen against the curvature of the earth (At least we proved that the Earth is round!).

After the balloon burst the tracking and recovery team sprang into action. An extensive team was assembled consisting of six T-hunt vehicles, a chase plane and even a chase helicopter! Members of the Los Angeles T-Hunt club were tracking the balloon throughout the flight with direction finding equipment. One of their members was located on top of a nearby mountain and provided a very accurate triangulation of the balloon's position. Tracking became difficult when the two meter signal faded away after the first hour of flight. It was later discovered that the VHF Engineering transmitter output dropped to only a few milliwatts when the internal temperature fell below 49 degrees. Also the violent return caused the ATV antenna on the end of the RG-58 coax to tear off at the package. Still minutes from impact all signals had ceased from the package! The Bellanca chase plane flew towards the best estimate the T-Hunters could provide of the package's location. Suddenly Mike, WA6SVT, monitoring the ATV signal in N6ESW's airplane shouted out that he could see the video. The signal grew stronger and houses could be seen on one side of the open desert. Then he saw a glimpse of an airplane wing and looked out the window to see a white streak as the package zipped by only a few hundred feet away! The desert floor could be seen rising up quickly and then the signal faded away. Fortunately the two meter signal reactivated as the package warmed shortly after impact and allowed the two closest chase vehicles, N6MI and KB6-MMF, to point their beams toward the package. Tom, W6ORG, simply flew his helicopter over the chase vehicles and headed in the direction they indicated. After only a 10 minute search Rick, N6UEM, flying with Tom in the helicopter spotted the package on the desert floor. They landed next to it and helped the chase vehicles find the location. The balloon had travelled 22 miles north of the launch site to land near the small town of Helendale.

Upon examination it was found that the parachute had ripped to shreds when the balloon had burst and the package had made a total free-fall from 20 miles up! However the package sustained only minor damage and the camera and ATV transmitter were still sending out a picture of an upside down mesquite bush!

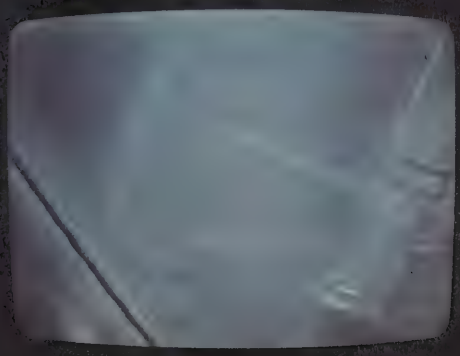
Thanks to all who participated and especially to Rod, WB9KMO, for his invaluable help in construction of the package. More flights are planned for the upcoming year including a balloon ATV Repeater!

K6KMN

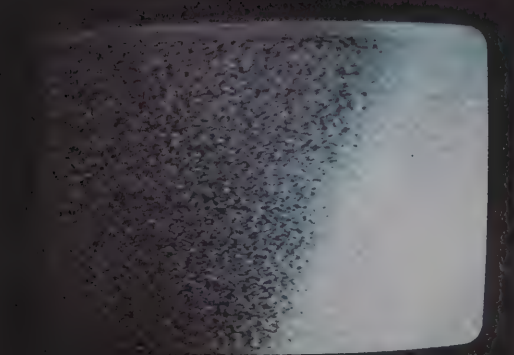


LAUNCH

100 ft



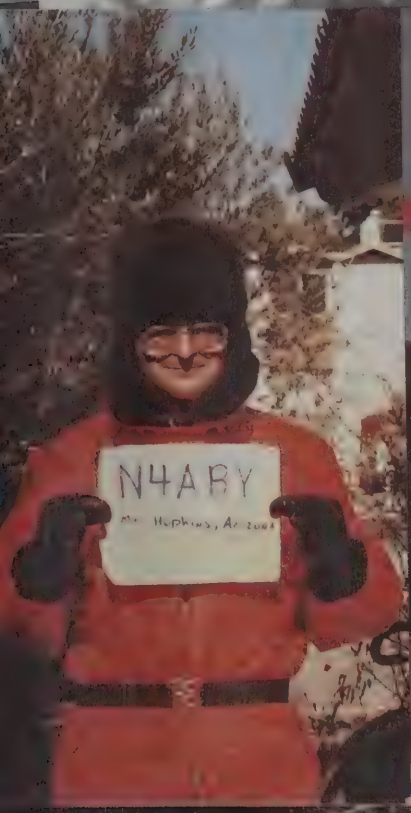
5000 ft



105,000 ft

CDTV
W9PRD
KDØLQ
KDØFW
KDØFW
KANSAS CITY MISSOURI
LISTEN 144235 SSB
147045 FM
ARCH

FROM SOUTH


N4ABY

LOU
AAA
W7LNX
PHOENIX

ON THE ROAD WITH THE ELK

Bill WB8ELK

In mid-December a cross-country ATV adventure was started leading from Ohio to California. Piling my mobile TV system into my station wagon, my co-pilot Louise and I set out to contact ATV'ers in as many corners of the country as we could.

OHIO

Home Base, Findlay.

In northwestern Ohio there are dozens of ATV'ers active. The following stations can be worked just about any night in the local area: Joe, WB8MSJ - Jeff, KA8WLV - Dick, WB8VNC - George, WA8HDX - Harold, WA8HDY - Dick, K8LZG - Jan, WM8W - Bob, W8RSK - Dan, W8PXU - Paul, W8ZD - Mark, N8GVF - Mel, KA8LWR - Lou, KZ8P - Lowell, K8PYQ - Jim, W9AZO - Brian, KA8IGU - Bill, WB8URI - Harold, KA8MDT - Mike, NM8E - Bud, KA8ATI - and Dave, WB8PJZ. The 2 meter talk frequency is usually 147.45 Mhz for local activity although 144.34 Mhz is also monitored quite a bit for DX contacts. A lot of activity occurs during the evenings hours however KA8LWR, KZ8P, K8PYQ, and W9AZO usually keep the airwaves warmed up from midnight till 3am every night. Starting out on our trip we were able to watch my dad, WB8MSJ and my brother, KA8WLV for about 30 miles. The first ATV repeater system was encountered in Lima, Ohio 35 miles from Findlay. Dave, WB8PJZ has put together a vertically polarized system with 439.25 Mhz input and 421.25 Mhz output. The WB8ULC repeater is located in the center of Lima on top of a 200' tall bank building. The Lima machine was one of the first systems to gain permission to send out the Kavorous weather radar feeds. A touchtone access on two meters will bring up the Ft. Wayne radar which is linked in from a remote site at a commercial radio station. Talk frequency is on 147.45 although a call on the 146.67/.07 repeater will usually net you one of the local ATV'ers.

100 miles down the road the Dayton ATV repeater was seen on 426.25 Mhz (W8BI/r). This system also is vertically polarized although most simplex contacts are horizontal in the midwest. Most of the locals have some way of flipping their antennas from horizontal to vertical through some rather ingenious methods. My particular favorite is W8RVH's Rube Goldberg system of pulleys and motors to twist his huge collinear over on its side. The Dayton machine has a 439.25 Mhz input as well as a weather radar link from the airport on 923.25 Mhz. Bruce, WB8UGV has been taking care of the repeater for the last 8 years and is usually monitoring 147.45 Mhz during the weekends. One nice feature that will help to find the signal when driving through is that any signal on 147.45 Mhz will bring up a computer I.D. on the output for several seconds. Look for this one when attending the Dayton Hamvention as it put's in a healthy signal over the entire Dayton area. Simplex activity is guaranteed every morning on 439.25 Mhz between 7:30am and 8:00am as W8RVH, W8BLN, W8EHW, WA8KQQ and WB8UGV have a schedule with W9NTP and W9PRD in Indiana on 144.34 Mhz.

INDIANA

No trip to Indiana is complete without a visit to the "Wild West" farm of Don Miller, W9NTP in Waldron. Don and Sue, W9YL, operate WYMAN RESEARCH from their farm southeast of Indianapolis. Don is a true pioneer in both SSTV and ATV and has developed a complete line of ATV gear over the years. He recently has been offering FM ATV equipment for the 1200 Mhz band. Don also is quite an archeologist and has an amazing display of Indian artifacts in his museum. Don has a daily schedule with the ATV'ers in Dayton and Springfield between 7:30 am and 8:00 am on 144.34 and his 500 watt ATV signal usually can be seen as far away as Findlay, Ohio (160 miles) every day. He quite often can be found as net control for the SSTV net every Saturday on 14.233 Mhz.

Fifteen miles away in Greensburg can be found another very active ATV'er. Bob, W9PRD has been responsible for organizing two balloon launches from Indiana during the past year attaining heights over 110,000 feet. A visit with Bob and Michelle is always a pleasant experience.

Indianapolis is home to the K9LPW ATV repeater. This machine has an input on 439.25 Mhz (Lower sideband to minimize FM repeater interference) and an output on 425.25 Mhz and is vertically polarized. A touchtone access on 2 meters will bring up a few minutes of weather radar and color bars. The repeater is located on the east side of Indianapolis and could be seen over 30 miles away in my car. Lots of activity exists in the area just about any night. Talk frequencies are 144.34 Mhz and the 146.76/.16 repeater.

It's impossible to escape Indiana without running across several more ATV types. In Lafayette you will find a whopping signal from Jeff, KA9TGX. With his Henry amplifier and 100 foot tower Jeff is responsible for stirring up many DX contacts. If you receive his picture you will be treated with some amazing AMIGA graphics and special effects. His impressive display of monitors all tuned to various satellite feeds, test patterns and the like rivals that of a network newsroom. Further down the road in Hebron you most likely will run across Garry, K9WZB and Tobi, KA9MMY. Even though 200 miles away from my home QTH Garry and I work each other several times a year. Both Garry and Jeff monitor 145.01 packet and can be alerted of a band opening via a packet connect immediately. This system has resulted in many successful TV contacts when even a direct voice transmission contact couldn't make it.

ILLINOIS

As you pass through the Champaign-Urbana area you will encounter Mark, KA9SZX and Tim, KA9SZY. Local contacts are few and far between but several QSO's have been made with KA9TGX in Lafayette and the Springfield group. Mark has been active in tracking the balloon flights this year and may try a balloon flight from Champaign sometime this year.

ELK ON THE ROAD continued . . .

In Springfield contacts can be made with Gene, WB9LHD and Bill, K9KKL. Nearing the St. Louis, Mo. area Scotty, K9SM in Hillsboro is also quite active.

MISSOURI (St. Louis)

A visit with Dave, WB0ZJP and John, KD0LO will put you in experimenter heaven! Dave and John have both made DX ATV contacts in excess of 400- 500 miles several times over the past few years. They have most recently been designing an 910 Mhz FM ATV transmitter as well as trying contacts on every microwave frequency imaginable. I particularly enjoyed their story of tracking down a strange interference on the 2300 Mhz band. It seemed that the interference only occurred between 5-7pm and 11pm to midnight. It turned out to be microwave oven leakage from the neighborhood as everyone cooked dinner or warmed up a quick midnight snack! We had quite an enjoyable weekend working all the local ATV'ers. Give a call on 144.34 Mhz when in the area and you will most likely raise one of the group. Some of the more active ATV'ers that can be worked are John - KD0LO, Dave - WB0ZJP, Dale - NI0D, Everett - KB0WG, Jim - WB0OOL, Earl - WD0FCH, and Earl - W0DDZ.

After having lived back in the flat lands of the midwest the past four years I started getting the urge to do some mountain-topping. I searched St. Louis for the highest spot to operate from and finally found it. You guessed it...the "Gateway to the West" itself, the gleaming Arch of St. Louis! Taking an ATV station up to the top of the Arch is no easy feat. Although a TV camera, a small ATV transmitter and battery pack are fairly unobtrusive, a 2 element quad on a mag-mount definitely attracts a lot of attention! It probably would have been easier to scale the outside of the Arch than to answer all of the question posed by the numerous park rangers, ticket takers and elevator operators who kept a wary eye on me and Louise. We both felt like Arch Terrorists! I finally fended off the suspicious looks by explaining that the quad was actually a great example of cubism art I had just bought. Finally reaching the top of the 600 foot arch we were presented with 6 inch high windows which although providing a fantastic panorama of the St. Louis area was virtually impossible to fit a quad into. It also turned out that with it's tons of thick stainless steel the Arch was a very effective RF shield! Even with all of the obstacles contacts were made with several of the local ATV'ers out to over 25 miles distance. We looked sufficiently wierd trying to stick the antenna out the window that a punk rocker actually said "FAR OUT" and took our picture.

After an enjoyable visit, we set out towards the Independence/Kansas City area. There we visited Mike, KD0FW, who is putting together the Kansas City ATV repeater. Input is 439.25 Mhz with an output on 426.25 Mhz (Horizontal polarization). Several ATV'ers are active in the area and monitor the 147.045 repeater. The ATV repeater will be located 27 stories high in a skyscraper in the downtown area and should have quite a coverage area. Already the 4 watt test signal has been seen regularly 50 miles away at a P3 level.

KANSAS (Wichita)

The Wichita ATV group has a vertically polarized repeater located in the north part of town. It's input is 434 Mhz and outputs on 421.25 Mhz. We were able to receive K0LXO's picture quite well over 30 miles away in the car. While in Wichita we visited Bob, N0HKI who has checked into the ATV HF net many times. The Wichita area is fairly isolated from other ATV groups but there may be a chance that contacts can be made with the Kansas City and Tulsa, OK groups eventually.

NEW MEXICO

Anybody out there? If there are any ATV'ers in the state please let us know as I'd like to work you on my return across country!

ARIZONA - (Tucson)

Just one lonely ATV'ers was found. Roy, N4ABY would like to become active again on TV if anyone else is interested in the area. Roy occasionally does work at the Multiple Mirror Telescope on 8000 foot Mt. Hopkins and also Kitt Peak observatory. On his last trip to Mt. Hopkins we gave him a Kreepie-Peepie and the infamous quad. Except for the three inches of snow that accumulated on his parka his picture was snow-free into Tucson 50 miles away. It was quite a treat to get a private tour of one of the largest telescopes in the world as Roy showed us around the facility on ATV. (Phoenix) As Louise put it; "We've seen pockets of ATV'ers so far but now we're in the midst of a whole NEST of them!!" Dozens of very active ATV'ers abound in the Phoenix area. Several days were spent touring around visiting the members of the AAA5 club with Earl, KS8J and Tommy, N7KBO. The KS8J repeater is located in the center of Phoenix on top of 1000' Shaw Butte. The input is on 434 Mhz and an output on 421.25 Mhz and is vertically polarized. Also another repeater is currently located at WA7TSD's QTH and will have a 434 Mhz input and output on 1253.25 Mhz. Earl, KS8J, is most noted for his aeronautical ATV adventures from 30,000 feet in a jet while testing FAA equipment over Minnesota and Wisconsin.

Last November, a real ATV first occurred during the Thunderbird Hot Air Balloon Race. On board one of the 160 balloons Earl and Tommy were married high over Phoenix. Area ATV'ers and onlookers at the launch site witnessed the ceremony televised via the on board 434 Mhz transmitter. Although the camera slipped partway during the proceedings, (a wonderful view of their feet could be observed!) the wedding vows could be clearly heard via the subcarrier. From a nearby balloon Norm, WV7K and Wayne, N7MAO sent back pictures of the ceremony from yet another camera angle. Not only that, they were able to establish a two-way balloon to balloon ATV QSO with the newlyweds. The happy couple have been floating on air every since!

Mountain-topping and mobile ATV are popular activities in Phoenix. It didn't take much encouragement to spark a round of DX-

peditions to some of the local high spots. Louise and I decided to try some contacts from 2000' South Mountain on the outskirts of town. The panoramic view of the entire area provided numerous P5 contacts with many of the ATV'ers below. Shortly after arriving a beat up van pulled up beside us. Expecting a bunch of partying rowdies to emerge we were quite surprised when the doors flew open. Four ambitious teens popped out to set up antennas, cameras, and a generator. Inside was a ATV station complete with a 50 watt amp and an AMIGA computer for graphics! With N7LWO, KB7EXU and KB7EXY on the AMIGA graphics keyboard and Chris, KA7SMI manning the camera we were able to work them two-way mobile while driving back. The next day Norm, WV7K went on an expedition to the top of 9000' Mt. Lemmon 120 miles to the southeast near Tucson. With 50 watts from his truck he was seen P4-P5 back in Phoenix.

Lou, W7LNX is one of the pioneer spirits that got ATV rolling in the area many years ago. Lou will always go out of his way to help newcomers get started on ATV. If you would like to exchange pictures with the AAA5 group you might be able to do so via SSTV if you contact Bob, WB7-CAM. Bob can be found on the SSTV net on 20 meters and can relay some of the local ATV signals by way of slow scan TV. NOTE: If there is interest in linking ATV groups together via a 20m SSTV network please write to ATVQ with suggestions of time and frequency.

The ATV calling frequency in Phoenix is 145.17 Mhz and there is a net every Wednesday night at 7:30 pm on the 147.28/88 repeater.

CALIFORNIA (Los Angeles)

After a week of meeting with some of the 200+ ATV'ers in the LA area and having seen the Rose Parade activities, Louise was convinced that I had taken her from a NEST of ATV'ers and thrown her into a whole SWARM of them!! With all of the tall mountains surrounding the LA basin an extensive network of ATV repeaters have sprung up over the years. The ATN group (Amateur Television Network) has been busily liking up these repeaters with plans to cover virtually all of southern California. The furthest east of these is on SANTIAGO Peak. With an altitude of over 5500' this repeater covers most of the LA basin. Input is on 434 Mhz with an output on 1253.25 Mhz vertically polarized. Mike, WA6SVT has been instrumental in maintaining this machine and has eventual plans to link up to the Phoenix, AZ group.

The OAT Mountain repeater, NU6X/r, covers the San Fernando Valley and links into the SANTIAGO repeater. It's input is 434 Mhz and outputs on 923.25 Mhz. By means of a 1253.25 alternate input, this machine can link up with the output of Santiago Peak to better cover the San Fernando Valley.

On top of 5000' MT. WILSON above Pasadena you will find the K6KMN ATV repeater with an input on 434 Mhz and output on 1241.25 Mhz.

In SAN DIEGO there will soon be a repeater (WA6VLF/r) with 434 Mhz input and output on 1277.25 Mhz located on Mt. San Miguel.

LOOP CANYON north of the San Fernando valley has a repeater (WA6ZVE/r) with 434 Mhz IN and 1277.25 Mhz OUT. Simi Valley and the Ventura area are covered by the SULPHUR Mtn. machine 434 IN - 1253.25 OUT.

In SANTA BARBARA the WB9-KMO repeater is located at 2600' on Gibraltar Peak. It has an input on 434 Mhz and outputs on 1277.-25 Mhz (10 watts). This machine will be linked soon to the other repeaters. Rod, WB9KMO, also plans to link up eventually with the northern California group.

The Los Angeles area is the home of P.C. Electronics. Tom, W6ORG, has been offering a complete line of ATV receiver and transmitter modules and transceivers for many years. As a result of Tom's efforts, getting started in ATV is far easier than it used to be and has been a major influence in the current popularity of the mode. Tom really enjoys the mobile capabilities of ATV. He has carried systems on board everything from Motorcycles, Airplanes to Helicopters.

The two meter calling frequency in Southern California is 146.43 Mhz. There are three weekly nets. The Mt. Wilson net chaired by K6KMN meets Monday night at 8pm. Tuesday night at 8pm Santiago Peak and Oat Mtn. have a net chaired by Phil WB6LQP, Ernie WB6BAP or Mike WA6SVT. Also on Tuesday at 8:30pm the Sulphur Mountain Net meets in the Simi Valley area on the 146.88/.28 repeater.

The Roving "ELK" will be visiting groups in other corners of the country during the year. Next on the list is the Northern California group and possibly Texas and Oklahoma. 73's and CU on the Road.-..Bill - WB8ELK

Henry KB9FO ATV Mobile. 20 element GP YAGI, 200 W AMP, = 12 KW ERP. Wind tested to 100 MPH & 96,000 miles!

SAY YOU SAW

IT IN ATVQ!

WA6SVT VIDEO PROCESSOR

In some older ATV transmitters high frequency roll-off and sync compression can become a problem. Also if driving solid state amplifiers for that extra watt sync compression can be quite pronounced. This Video Processor circuit will compensate for these situations and has four controls: 1) Sync Level, 2) White Clipping Level, 3) High Frequency Equalization, and 4) Composite Video Level. The input impedance is 75 ohms so no termination is needed. The module can be built into a separate box and placed in the video line leading into your ATV transmitter. Also you could mount it directly inside the transmitter if room permits. 47 UF tantalum capacitors are used although they can be substituted with 100 uF electrolytic caps.

ADJUSTMENTS:

1) Set the controls of the processor as follows, Sync Level--fully counter clock wise, High Freq. Equalization--center, White Clipping--fully counter clockwise, Composite Video Level--center.

2) Apply power with video signal input and a 75 ohm load on the output.

3) Connect an oscilloscope to the output and adjust the Composite Level for 1 V p-p.

4) While monitoring the demodulated output of your ATV transmitter set the Sync Level for 1/3 sync to 2/3 video. For those without a line sampler, have a distant station look for the most stable signal while adjusting the sync.

5) Adjust the High Freq. Equalization control for a flat video response and best color burst level.

6) Adjust the white clipping level so any video above 100 EIA are clipped. This will keep the ATV transmitter from whiting out (flat topping) on very bright objects.

The following will be available from ELKTRONICS, 12536 T.R. 77, Findlay, OH 45840:
Blank Circuit Board - $7, Kit (blank board and parts) - $29, Assembled/Tested - $39.

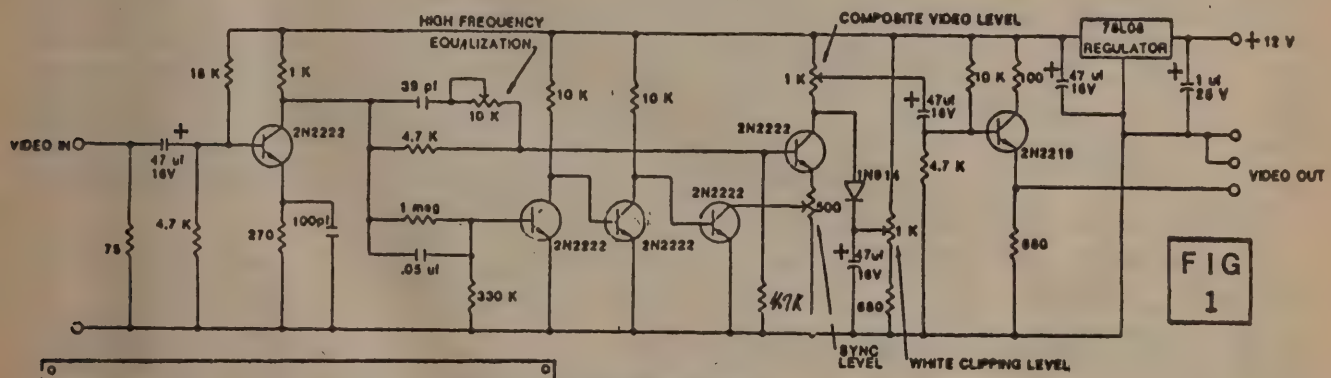


FIG 1

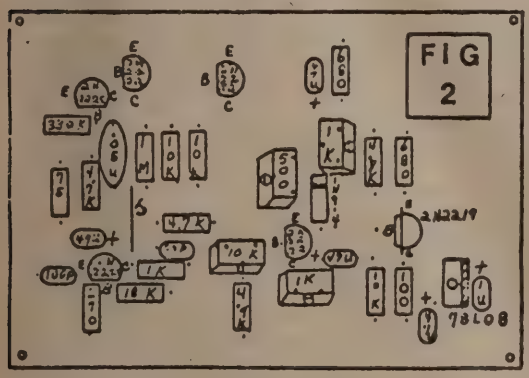
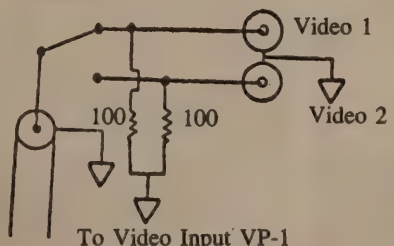


FIG 2

Two Video Inputs
SPDT Toggle
Switch



To Video Input VP-1
8 Inch Max Length

FIG 3

Remove the 75 ohm resistor from the VP-1 and replace with a 330 ohm +W resistor.

DIGITAL VOICE LD.

Bill WB8ELK

DAK corp. is offering a close-out sale on a device known as the Cyberex ANSWER BACK. It was designed to record your voice digitally and play it back as a telephone message. It digitizes up to 15 seconds of voice and stores it as long as power is applied. The output is good quality and could be used as a voice I.D. for repeaters and hidden transmitters. These can be purchased for $15.90 direct from DAK Industries. To order call (800) 325-0800 and ask for cat. #4859. For more information call (800) 888-7808 and refer to either the Backtalk Plus or Gone Fishing Plus.

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Use your existing HF or 2M rig on other VHF or UHF bands.

RECEIVE CONVERTERS			LINEAR TRANSVERTERS		
MMk	1691-137	333.00	MMt	1296-144G	499.00
MMk	1296-144G	235.00	MMx	1268-144	395.00
MMc	439-ATV	99.00	MMt	432-28(S)	370.00
MMc	432-28(a)	89.00	MMt	144-28(R)	499.00
MMc	144-28(HP)	95.00	MMt	144-28	265.00
MMc	144-28	75.00	MMt	435-28(S)	390.00

PRE-SELECTOR FILTERS

Spectrum International's low loss, fixed tuned, band-pass filters are a 3 pole, 7⅞ bandwidth Interdigital design. The 0.1 dB ripple Tchebyscheff characteristic has a 30 dB shape factor of 4:1. They are intended for receiver pre-selector and transmitter applications. The very low loss is realised by using an air dielectric transmission line design.

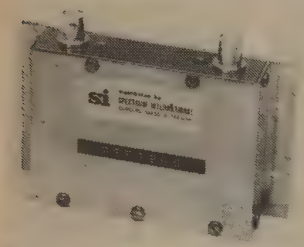
Technical Date

General:	Ripple	0.1 dB
	Impedance	50 Ohms
	VSWR, typ	1.25
	Power, nom	100 W (BNC)
		250 W (Type N)
Size:	Width	4.0 ins approx
	Thickness	1 inch
Material:	Brass	Plates, Rods & Bars
	Hardware	Stainless Steel

VHF/UHF BANDPASS FILTERS

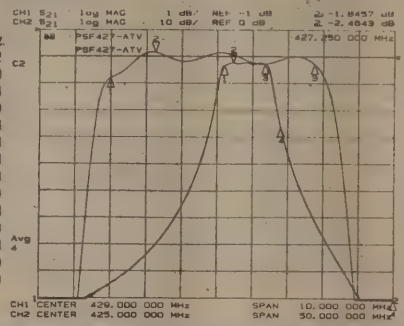
KNOCK OUT INTERFERING QRM OR SELF—DESENSE!

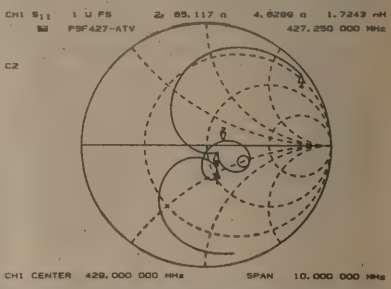
3 and 5 pole models available



BNC Standard
TNC or Type 'N' optional
(slightly higher prices)

MMF-200-7	145 Mhz.
PSF 137-3	132-142
PSF 144-3	140-150
PSF 220-3	216-228
PSF 432-3	420-450
PSF 421-5	ATV Channel
PSF 426-5	ATV Channel
PSF 434-5	ATV Channel
PSF 439-5	ATV Channel
PSF 900-3	890-940
PSF 923-5	ATV Channel
PSF 1280-3	1230-1320
PSF 1280-5	ATV Channel
PSF 1296-3	1250-1340
PSF 1691-3	1650-1750


CH1 S21 log MAG 1 dB/ Mkr -1 dB 2: -1.8457 dB
CH2 S21 log MAG 10 dB/ REF 0 dB 2: -2.4843 dB
PSF427-ATV
PSF427-ATV
427.250 000 MHz
CH1 CENTER 429.000 000 MHz SPAN 10.000 000 MHz
CH2 CENTER 425.000 000 MHz SPAN 50.000 000 MHz



U.H.F. Filters		U.H.F. Filters	
MMf 200-7	$ 55	PSf 923-ATV	$155
PSf 137	175	PSf 1280	95
PSf 144	175	PSf 1280-ATV	155
PSf 220	145	PSf 1296	95
PSf432	95	PSf 1691	95
PSf 421-ATV	145	**Connector Options for Filters**	
PSf 426-ATV	145	for MMf200-7 U.H.F	$ 45
PSf 434-ATV	145	Type "N"	15
PSf 439-ATV	145	for PSf... Type "N"	20
PSf 900	95		

Prices subject to change without notice.

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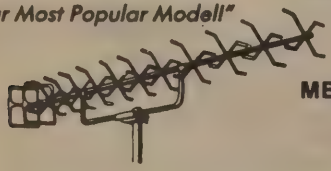
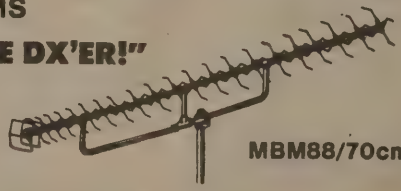


MBM48/70cm

"THE DX'ER!"



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2 way & 4 way Mounting Frames Available (Vertical slightly higher)
MF4H MBM48 HOR $69.00
MF4V MBM88 HOR $87.00

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"WE STOCK 2 AND 4 WAY POWER COMBINERS FOR 1268, 1296 and 1691 Mhz.!"
NEW 900 Mhz. BEAM IN STOCK!

10XY/2M 5XY12M or 137 Mhz. Models
Ideal for OSCAR or WEFAX Satellites!

SPECIFICATION	MBM28	MBM48	MBM88
FREQUENCY (MHz)	430-440	430-440	430-440
GAIN (dbd)	11.5	14.0	16.3
FRONT TO BACK RATIO	18 db	20 db	22 db
3db BEAMWIDTH	H45° E40°	H35° E28°	H28° E23°
DESIGN IMPEDANCE	50 OHMS	50 OHMS	50 OHMS

10XY	5XY-137	DY-20-900
144-146	134-138	900-930
10.8	7.8	17 dbi
16 db		20 db
E40°	H 58°	H 32°
		E 22°
50 Ohms	50 Ohms	50 Ohms

Four-way harness

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STACKING FRAMES AND MOUNTING KITS

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PMH/2C	2 way phasing harness for circular polarisation for two 2m aerials
PMH137-C	Circular harness for 5x4/137
MF2-48	48 element stacking frame $18.00
MF2-88	88 element stacking from $22.00
SVMK-48	Vertical Pol Mounting Kit $22.00

All phasing harnesses and power combiners include Type 'N' (female) connector.
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Antennas	
5XY-137 (137 MHz Weather)	$ 90
10XY-2M	83
MBM28 - 70cm	65
MBM48 - 70cm	90
MBM88 - 70cm	135
DY20 - 900 (900/930 MHz)	89
1268-LY	65
1268-LY-XTN (add 21 elements)	89
1298-LY	65
1268-LY-XTN (add 21 elements)	80
1691-LY	75
1691-LY-XTN (add 26 elements)	70

Note: 1. All antennas include 50 ohms build-in BALUN.
2. Order Loop-Yagi connector from accessory list below.

Harness Kits	
PMH-137C 137 circ Pol	$ 20
PMH- 2C 2M circ Pol	20
PMH2-2M 2M 2-way	23
PMH4-2M 2M 4-way	55
PMH2-70 70cm 2-way	20
PMH4-70 70cm 4-way	37
900-2way (combiner)	ask
900-4way (combiner)	ask
1268-2way (combiner)	65
1268-4way (combiner)	95
1296-2way (combiner)	65
1296-4way (combiner)	95
1691-2way (combiner)	65
1691-4way (combiner)	95

Stacking Frames	
2-way	
MF2 -48 MBM48 H/V	$ 30
MF2 -88 MBM88 H/V	24
4-way	
MF4H-48 MBM48 Hor	$ 69
MF4V-48 MBM48 Vert	79
MF4H-88 MBM88 Hor	69
MF4V-88 MBM88 Vert	89

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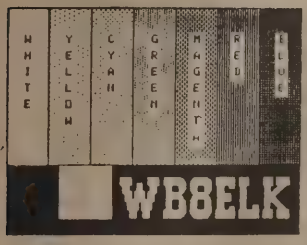

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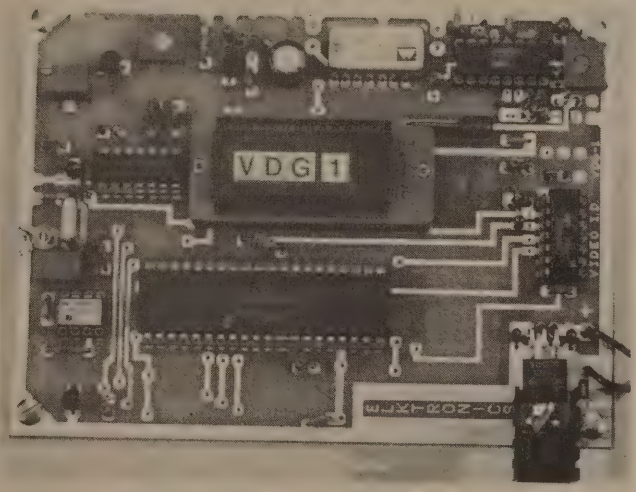
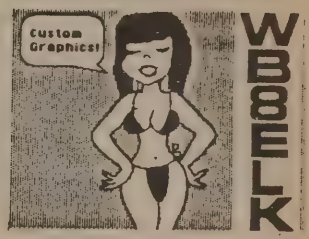
VIDEO I.D.





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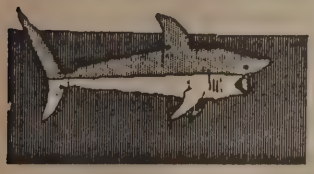

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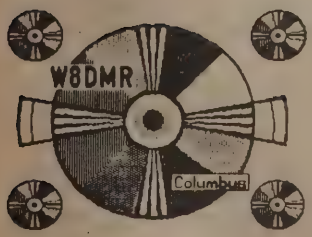

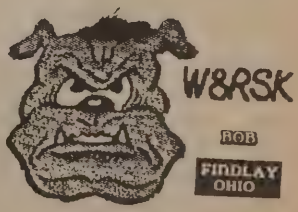

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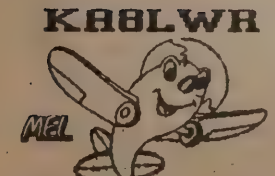

IN BUCYRUS, OHIO

KA8WLV
WHERE NO ATV'ER HAS GONE BEFORE

COMMODORE AMIGA AND AMATEUR SSTV/FSTV

by John Spaeth KDØLO

Just when you think you've seen about everything, someone will come along with a new widget that proves you wrong. So it is with Commodore's relatively new offering the Amiga (500, 2000). Although this computer has been around for several years, it is just now coming into its own as far as ATV'rs are concerned.

The Amiga 500 and 2000 are basically the same machines, however the 2000 is easier to expand (i.e ram,hard disks etc.) The 2000 also comes packaged more like a standard P.C. Clone in a metal cabinet with internal expansion slots and built in power supply. The 500 comes with 512k ram and the 2000 comes with 1 meg ram. The 500 requires a rather involved process to expand beyond 1 meg of ram including an outboard expansion chassis while the 2000 can easily be expanded to 8 meg of ram with the addition of an internal "plug-in" ram board which can be added increments of 1 meg.

While the Amiga is hailed as the video enthusiasts computer it does have a voracious appetite for memory. The machine is a multitasking computer able to run several programs simultaneously in addition to supporting 2, 3 1/2 inch 880 kb disk drives. It can also be fitted with a bridge board which will allow full compatibility with PC software. That's right, add an optional 5 1/4 disk drive and all your PC software will boot and run. The video display is available in either NTSC or PAL but will not run both simultaneously. The video display is able to present 4096 colors on its RGB analog monitor and has up to 512 kb of ram dedicated to its video memory wow! At the expense of going on with system specs, suffice it to say that this is THE premier computer for video applications.

The big news on 14.2 mhz these days is the new offering from Black Belt Systems 406 367--5509. Imagine a SSTV system that supports ALL Robot modes, weather fax, news fax, Volker-Wrasse line sequential and has its own mode to boot. The AVT hard software from black belt does all this and more for under $200.

The hardware consists of a 3x5 inch circuit board which you must enclose and power with 12 volts D.C. A cable is provided which connects this board to the parallel port of the computer. The receive audio must be routed to the board through any cable connector you choose. The transmit audio comes directly from the computer at line level.

After booting the program the crt goes black and an attractive and colorful switch panel fades onto the screen. This panel looks like the membrane keyboard found on the 1200C. Functions are selected by moving the mouse controlled cursor over the top of the function button on the screen and "clicking" the mouse control button. This procedure is used for transmitting, receiving, processing etc. The computer keyboard never really has to come into play which is good news for poor typists like myself.

To receive Robot 36 sec composite color simply move the cursor to the 36 button, then the composite button then the receive button, clicking on each as you go. The image will be retained in a buffer area as it is received and although you will be able to see the image as it comes in--the program will have to process it after reception. This process takes about 10 sec. The composite color picture is then displayed. A computer with more than 1 meg of ram will hold up to sixteen such images in its current buffer and each one is immediately accessible with a keystroke, much like flipping through a photo album. These images may be saved to disk at any time. The image on the front most screen can be sent out in any Robot mode by selecting the transmit speed, synthesizing the image and clicking on the transmit button. Of course the front screen can be changed at any time to any of the sixteen images in the buffer or any of the images stored on disk. The image can be modified by adding a colorbar or grey scale strip to it or by writing text over the top of it. Both of these functions are included as program functions and the available text fonts are those supplied with the computer.

Additionally, the program provides options for color correction to the received image as well as line correction which allows the user to correct the image line by line. This enhancement actually allows you to remove any hits you may have received and make the picture appear noise free or correct the hue of a picture received off frequency.

Once satisfied that the program worked well with Robot images I moved to another mode of the program called the AVT mode or Synchronous Line Phase mode. This mode is unique to Amiga users with the Black-Belt system and boasts better color accuracy, positioning, and narrower bandwidth requirement. This mode also has a QRM option which will take an image ordinarily received with 50% noise and make it 99% correct due largely to narrower bandwidth requirement.

My initial reaction to this mode is positive having received images through impossible QRM. The color register was perfect and the image was correct yet the tones were just audible over the noise on the band. With over 400 registered users of this product I expect this mode will draw some attention on the bands and catch on rapidly.

Although I haven't tried any of the fax operations the program is capable 120 or 60 lpm rates in 16 grey levels with up to 1024 by 1200 resolution. Also included are full auto-start for transmit and receive with an "unattended auto-start" function. Fax images can be panned, flipped, rotated and of course saved to disk.

The author tells me the future will bring enhanced video (3-D capability) as well as the Panasonic 5 sec mode which is used with consumer telephone units. I was also told that any further updates including any new modes which might become avail-

able to the ham community would be sent to me. As of this writing I have already received one software update at no charge!

This program is not a substitute for the Robot 1200C as it will not do some of the things that the Robot unit will (live video frame grab for instance) but it is certainly compatible with it and brings to SSTV the new and exciting mode of AVT mode. More complete information can be obtained by calling Black-Belt at the number above or through the Amiga Ham Radio Users Net at 14.345 Mhz on sundays at 5:00 PM central, net control WB3KRN (Kathy). Next issue, a look at the Amiga and FSTV applications. 73's KD0LO.

BACK TO BASICS
HENRY KB9FO

Last issue we threw you a curve by giving a wrong answer to an Ohm's law problem. In our "survey" either no one knows Ohm's law, or no one was reading my column (pout). In either case no one wrote in to tell us, tricky aren't I?

As I write this we have 4 broadcast equipment maintenance engineer openings and 4 duplicator tech openings. Anyone looking for a job?

By the time you read this we will have a FAX number and a computer MODEM for direct delivery of your material! Watch for the announcement in the next issue of ATVQ.

Video Sidebands! Where do they come from and what do they do? Our topic. Video is composed of two basic forms of information, AC and DC. When ever the signal is steady state, unchanging, it represents a DC voltage level. This could be the sync pulse, blanking area or and flat video area in the picture. The AC components are generated by any TRANSITION in the signal. This could be the rise and fall of the sync pulses, or small changes in the video from object to object. The rate of change produces a characteristic frequency. The faster the rate of change, the higher the characteristic frequency. The greater the change in level the more energy is generated at the characteristic frequency. The highest frequency we are interested in is 4.2 Mhz. This is the limit of NTSC broadcast video bandwidth. From DC (video carrier) to 4.2 Mhz at multiples of the horizontal frequency (15,734 Hz) you will have sidebands. The sideband energy at any of these points will be directly proportional to the energy represented by the magnitude of the signal change in the picture at that frequency.

If you remember good old AM, then you know that the sidebands cannot have more than 50% of the power of the carrier. With video you have sidebands at multiples of the sync frequency (mostly) so the energy is centered around 274 sidebands. Simple arithmetic will tell you that 25% of your power divided into 274 sidebands means each sideband has very little energy. In fact you would have a hard time generating such a signal. In real life the sideband energy is typically 40 to 50db below your carrier power at frequencies of .5 Mhz to 4.2 Mhz removed from your carrier. More than half of the sideband power is usually in the first .5 Mhz area from your carrier.

With vestigial sideband transmission the lower sideband, from 1.25 Mhz out, is thrown away, but this represents less than 10% of your power! A color signal will have a number of strong sidebands centered at +3.579545 and these sidebands fall in between your luminance signal sidebands because the color carrier is 455 times the H rate (an odd number) and is thus interleaved. Even in full saturation though, the color signal amounts to about 10% to 15% of your total sideband energy and the color sidebands are insignificant after more than .5 Mhz from the color subcarrier.

This is why it takes about 50 db more signal to get a "perfect" tv signal than your typical NBFM, and why a weak NBFM signal 40 db below your desired signal will wipe out the received picture!

73 KB9FO

A TV Q HUMOR TEST

You say you never have anything to write us about? You say life is dull and you can't take it anymore? Well listen up bunky! It is time for a national A TV Q Humor test.

1. You say you got the January issue and you didn't subscribe?

A) You were too shocked at the amount of good stuff in 1 magazine about ATV and thought it was a fluke.

B) You are too cheap to subscribe and steal your ATV buddies copy! (Yeah, we know, ham's are cheap!)

C) You believe the "other mag" will get better. (We like the BATC's CQ-TV)

D) You were on your way to the ham store to get a copy and got caught in a tornado, flood, earthquake.

E) Your local ham store was sold out so you couldn't find the address to mail in your subscription.

F) Your tower blew down and you decided it wasn't worth putting it backup so why buy a magazine too.

G) You can't read! (then how come you can read this??)

H) You don't print any risque pictures! (This isn't Playboy!!)

I) There are too many pages and I can't spend three days reading only one magazine. (Well you got your money's worth didn't you?)

J) DX was in and the band was open for 48 hours and the lack of sleep caused you to have a mental lapse. (Yeah, DX of 3 blocks)

K) I've already got too many build-it projects. (Buy two soldering irons!)

THIS IS YOUR OPPORTUNITY TO SUBSCRIBE TODAY AND AVOID THESE EXCUSES IN THE FUTURE.

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SUBSCRIPTION FORM ON PAGE 21
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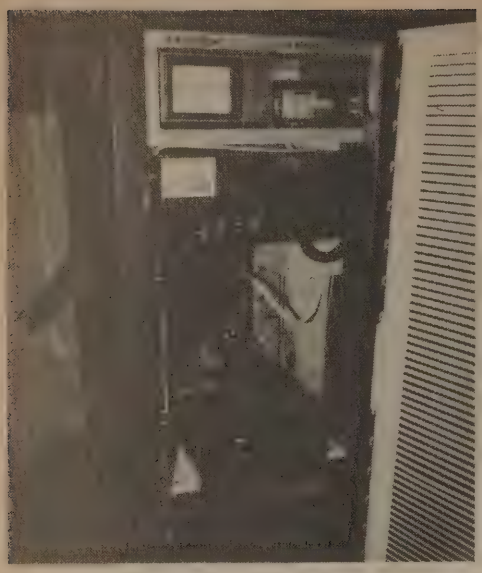

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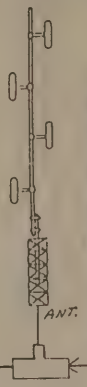
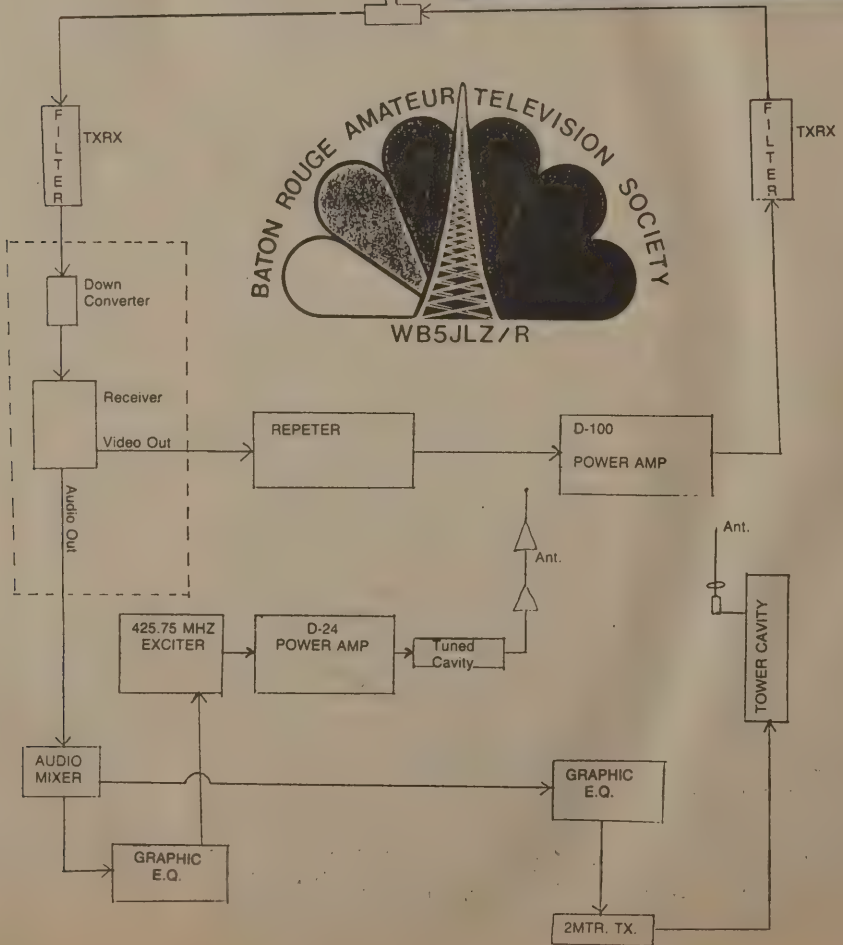




INEXPENSIVE HELIAX CONNECTORS

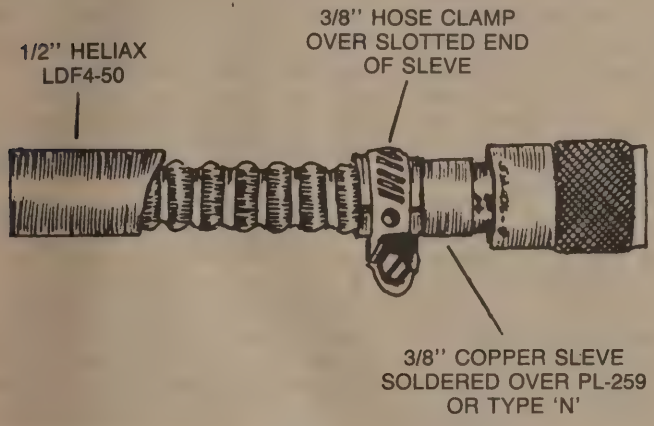
BOB - WD5BJW

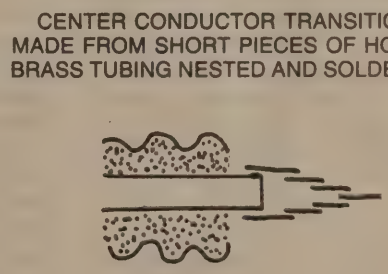
A few simple plumbing and hobby shop components can provide a considerable savings when you are in need of a connector for 1/2 inch Heliax such as Andrew LDF-50. With a 3/8 inch copper sleeve and hose clamp from your local plumbing supply, along with copper tubing sold at most hobby shops, you can assemble an effective RF coax connector. Using other plumbing transitions for different sizes of cable, you can easily adapt standard connectors to any size Heliax.

To begin, strip back 1 inch of the plastic covering and 1/4 inch of copper shield and foam exposing the center conductor. Next, slot the end of a 3/8 inch copper sleeve in an 'X' pattern; solder the other end approximately 1/4 inch over the rear of A type 'N' or Pl-259 connector. Slip the hose clamp over the sleeve and spread the slotted end open slightly.

Next, assemble the center taper. Your local hobby shop carries various sizes of brass tubing that nest in one another tightly with three or fours sizes. This will allow you to taper down from the Heliax center conductor to the center pin of the coax connector you are using. Start with 7/32 tubing and cut a piece 1/2 in long. Next, cut 1/4 inch lengths of the next three smaller sizes and nest each piece inside of the other 1/8 inch. Solder this assembly together. Slide the taper over the center conductor of the Heliax and solder using the minimum amount of heat so as not to melt the foam. In the case of the Type 'N' connector, measure and cut the correct length for the smallest tubing and solder the center pin to it. For a PL-259 use a piece of wire long enough to go through the center pin and solder the tip after assembly and cut off the excess.

Slide the sleeve and hose clamp assembly over the Heliax, stopping when the center pin reaches its correct position. Clamp the sleeve to the Heliax by tightening the hose clamp until it is firm, being careful not to crush the Heliax. The entire assembly can be water-proofed by wrapping it with rubber tape. (see Fig. 1).





"May I have the mouse back, please?"

ATV COMBLINE DUPLEXERS AND FILTERS

BY JON C. HENNING
WA2BTW

A duplexer, designed for use in amateur television, is quite a step away from a narrow pass-band FM duplexer. The bandwidth or range of frequencies passed is much greater. The rejection band width must also be very broad.

If a pseudo band-pass circuit (narrow pass-band broad reject) were used, the end result would be a much too narrow pass-band. If the approach taken was the use of notch-filters (broad pass-band, narrow rejection), the pass-band would be wide enough but the rejection notches would be too narrow. Therefore, the logical approach would be the band-pass circuit. The proper number of cavities must be determined for the required selectivity and each must be calibrated for a specific 3 dB bandwidth. Interconnect cable lengths have to be determined, since these are also a part of shaping the pass-band. This design works very well. However, there is a better alternative; the use of combline filters.

Combline filters eliminate interconnecting cables and connectors, which in turn results in a less distorted pass-band and sharper rejection roll off. Open air coupling is used in place of interconnecting cables. Figures 1 shows a cutaway view of a single combline filter. Shown here are six resonators and five coupling adjustments probes. In the lower left and right corners are band-pass loops located just under the first and last resonator. They are coupling in the current area of the filter and may be rotated in the field to increase or decrease coupling. The filter has a symmetrical pass-band, which means that either port may look toward the receiver or transmitter to the antenna (all ports 50 OHMS).

The coupling of each resonator is optimized to form the 6 MHz pass-band. Fine adjustments of the pass-band width can be made by slightly interacting with the voltage field between resonators. This is done by the coupling adjustors (Figure 1).

Problems with Full Duplex ATV Systems Using Two Antennas

If a station is going to "full duplex", the first thing to consider is the amount of isolation needed. Secondly, how that isolation is obtained. One way would be to vertically separate the TX and TX antennas. Twenty feet will produce about 55 dB of isolation in the UHF band. However, there are other variables involved, such as a tower coupling, where energy from the antenna actually couples to the other antenna via the tower itself. To determine the best placement of the antennas you could use a spectrum analyzer and signal generator. Inject a signal from the generator into the input of the analyzer and obtain a known reference level at the frequency you are working with. Next, inject this signal into one antenna and detect at the other with the analyzer (Figure 2).

Simply read the difference between your reference level and the new level. The 3 dB pads at the output of the signal generator and input to the analyzer are used to force the equipment to be a "true 50 OHMS." Move the antennas vertically apart until maximum isolation is obtained. Chances are additional isolation will be required to operate full duplex. Another drawback to a two antenna system is each antenna will see the environment somewhat different, making coverage uneven. The additional cost of the hard line and extra antenna should also be considered.

A single combline filter will work very well to suppress unwanted sidebands in a simplex ATV station. However, there are two RF paths to be dealt with in a repeater system. Obviously two combline filters must be used. And if a single antenna is to be considered, a harness must be designed to tie the filters together. While the procedure for this is simple, the equipment involved is reacting complex.

Using a network analyzer, sweep either the low or high frequency. For example, we are going to determine the cable length to be attached at the low frequency filter and the antenna junction tee, by connection a precalculated cable length (about 1/2 wavelength) to the low frequency filter. At the other end of the cable connect an "n" tee. Looking through the "tee", read the return loss at the high frequency. (Reference Figure 3). The best match condition over that frequency bandwidth (6 MHz) is what we are concerned with. If the best match seems to high in frequency, a longer cable is tired; if too low, a shorter cable is tired and so on. The same procedure is done using the high frequency filter. When both cables have been determined and the antenna "N" tee connected, each filter sees 50 OHMS to the antenna and a high impedance reflection to its adjacent channel, allowing simultaneous operation of the transmitter and receiver. The two filters now form a duplexer (Ref. Figure 4). With each side pretuned, some small adjustments may be required to each pass-band after the antenna junction has been connected.

Figure 5 shows the electrical response for the ATV duplexer. It was measured on a Hewlett Packard 8754A network analyzer. If you are accustomed to reading a spectrum analyzer, this should be easy to interpret. The vertical scale is read in either 1 db or 10 db per division increments. The scale left to right reads frequency (low to high). Curve A shows 1 this means that the curve reads 1 db for each vertical division. The same curve has 1.0 this shows each division horizontal is 1 Mhz.

The top two curve responses represent the pass-band, the middle two are isolation (rejection above and below the pass band)

and the single curve at the bottom is the between-channel isolation. Between channel isolation is read by injecting a signal into the TX port, loading the antenna port with a 50 ohm load and detecting at the RX port. Between-channel isolation helps protect the receiver from white noise generated by the transmitter. Should the transmitter have energies away from its own carrier frequency, toward the receiver, it will still be suppressed by the amount shown at any point on that curve. If you look at a straight notch duplexer, the between channel isolation is so low, usually less than 15 db, that it does not offer this type of additional protection. (ref figure 6). Again a notch duplexer would not work for the ATV applications: however, it's a good "rule of thumb" when either building buying any duplexer that it have sufficient amount of center isolation. The circuits that best offer this are band-pass and pseudo band-pass. The ATV combline duplexer shown here has a straight band-pass response, offering high isolation between channels as well as out of band protection.

In order to form a pass-band with low ripple and maintain an acceptable VSWR over such a wide range, the coupling must be greater on the outside resonators and be decreased moving toward the inside of the filter. If the coupling were greater on the inside resonators the pass-band could not be tuned.

As important, is the number of resonators needed to accomplish the selectivity required above and below the passband. Figure 7 shows a four section combline vs a six section version. Additional resonators could be worked into a filter design or two comblines could be cascaded in series, should additional selectivity be required. This is usually not required if the minimum transmitter to receiver frequency spacing is kept at 6 Mhz or more and the pass-band is kept at 6 Mhz or less. This is also true of the band-pass preselector mentioned earlier. In a four cavity preselector (ref. fig. 8) the two outside cavities would each be set at a 3 db band width of about 8.5 Mhz while the two inside cavities would be set at a 7 Mhz 3 db band width.

Additional isolation may be obtained in close to the pass-band by using notch cavity filters. THis is possible because this circuit style, as mentioned, has a broad pass-band. It must of course be able to pass the full 6 Mhz. If a notch cavity filter is set to reject 1 Mhz above the high end of the pass-band and connected in series with 1/2 of the combline duplexer, the total increase would not only be the sum of the two, but rather the sum of the two plus 5 to 6 db if the proper cable length is determined. By using the proper 1/4 wave-length cable, the energy from filter to filter will arrive in phase thus giving a 5 to 6 db addition to the total isolation. Determining such a cable length without proper equipment such as a network analyzer would be very difficult. If you were to measure the interconnect cable, you would see that it is somewhat less than a 1/4 wavelength because you must take into consideration the length of the loops in each filter (subtracted from the cable length). There are no set formulas for subtracting these lengths. One would start with a 1/4 wave cable to hunt the length. If the interconnect should be physically to short to reach, 1/2 wavelength of cable can be added thus electrically repeating your initial point. More than one notch filter may be used to reject above or below the pass-band, if additional protection is needed. Fig. 9A and 9B show a combline filter in the UHF commercial band, with six sections and three 1.25 x 2 inch notch filters. This system is set for a 4 Mhz window. One Mhz off the low side (notched side) the isolation is 45 db down and on the high side it is down 21 db. The amount of insertion loss added is about 1.2 db on the low side, 0.4 db at Fo and about .85 db on the high side.

POWER HANDLING CAPABILITY

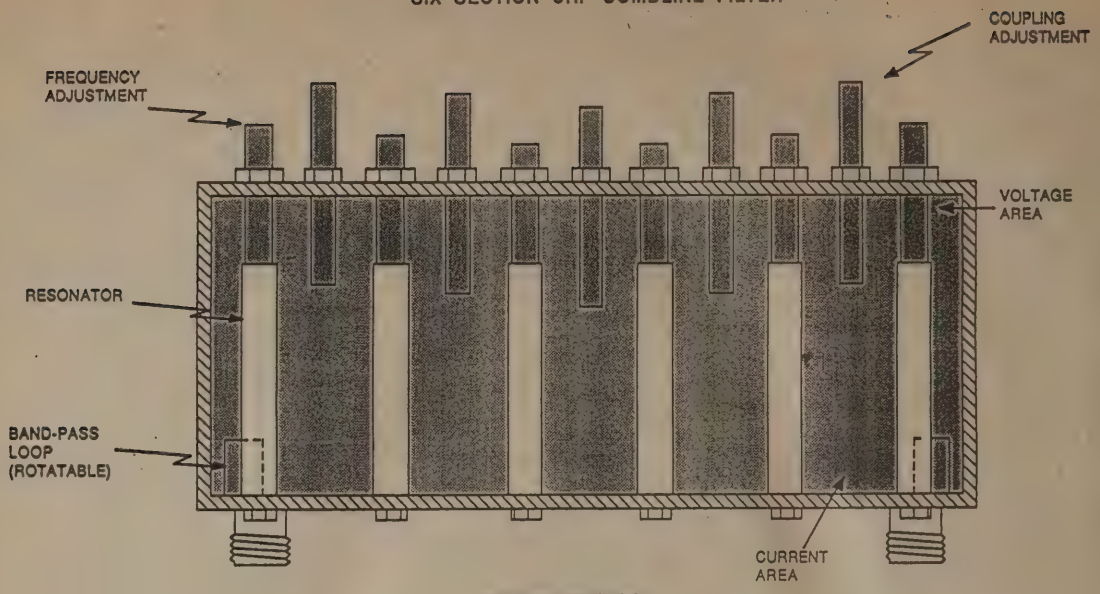
The power rating for this ATV duplexer design has been tested up to 100 watts continuous operation. At 100 watts there was no heating evident in either filter under test. Test cycle was 15 min on, 15 min off. Internal parts are examined closely to make sure that all components in high voltage areas have no sharp edges where corona could occur. The contact area of the resonators (current area) to the filter chassis (high current area) is very important. To maintain high Q there must be as close to a 100% contact area as possible. In addition, all resonators, tuning rods, coupling adjustors, loops and connectors are silver plated for better RF conductivity.

Figure 10 shows a grid used for calculation of power losses in/out vs insertion loss. This can be useful in determining pass loss not only in duplexers but in most RF paths. However it should be remembered that the field accuracy of a wattmeter reading is subject to considerable variance due to RF connector VSWR and basic wattmeter accuracy, particularly at low end scale readings. Allowing for these variances, this graph should prove to be a very useful reference. Lets say we have a 100 watt ATV transmitter and we know that the duplexer has a .9 db loss at its frequency. We should see, according to the graph, about 85 watts out. The scale is set from 50 to 500 watts. For lower power levels divide both scales by 10 (5-50 watts).

COMPARING CURVE RESPONSES

Fig. 11 shows the comparison of pseudo band-pass, band-pass, notch and the ATV combline filters. Even though these curves are hypothetical, they still represent the typical of responses each circuit will produce.

SIX SECTION UHF COMBLINE FILTER



SINGLE FILTER SPECIFICATIONS
SIX MHz PASSBAND

VSWR (max.)	1.35:1
INSERTION LOSS	1.0 dB max. @ Bandedges
NOISE & CARRIER SUPPRESSION	70 dB min. ±6 MHz off Bandedges
POWER RATING	100 watts
CONNECTORS	"N" female
MECHANICAL	9.5" H x 10.75" D x 7.25" W

FIGURE 1

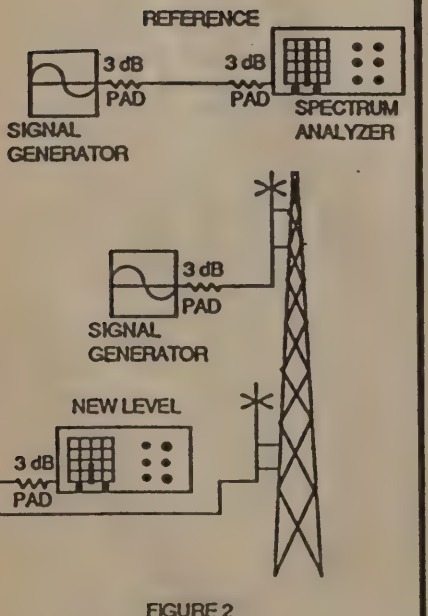
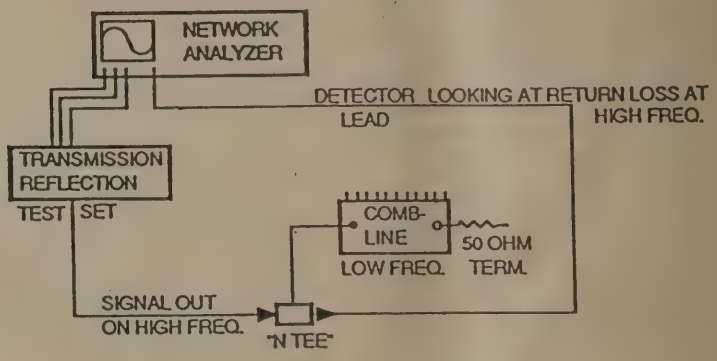


FIGURE 2

PROCEDURE FOR DETERMINING ANTENNA JUNCTION CABLE LENGTHS



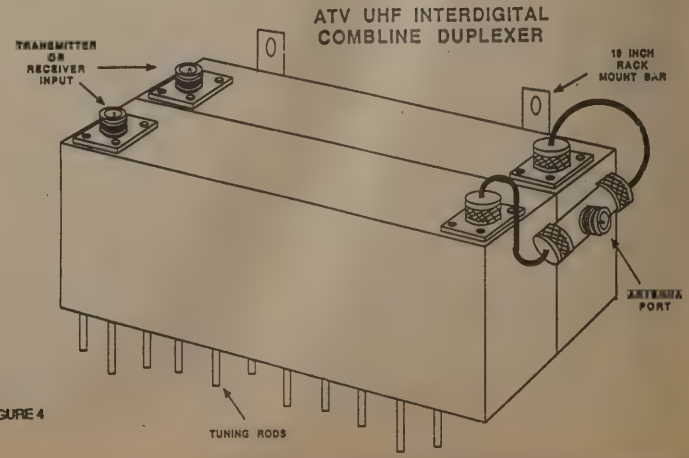


FIGURE 4

Return Loss (dB)	SWR	Return Loss (dB)	SWR	Return Loss (dB)	SWR
9.5	2.008:1	13.7	1.520:1	17.9	1.292:1
9.6	1.990:1	13.8	1.513:1	18.0	1.288:1
9.7	1.973:1	13.9	1.506:1	18.1	1.284:1
9.8	1.957:1	14.0	1.498:1	18.2	1.280:1
9.9	1.941:1	14.1	1.491:1	18.3	1.277:1
10.0	1.925:1	14.2	1.484:1	18.4	1.273:1
10.1	1.910:1	14.3	1.478:1	18.5	1.270:1
10.2	1.894:1	14.4	1.471:1	18.6	1.266:1
10.3	1.880:1	14.5	1.464:1	18.7	1.263:1
10.4	1.865:1	14.6	1.458:1	18.8	1.259:1
10.5	1.851:1	14.7	1.451:1	18.9	1.256:1
10.6	1.837:1	14.8	1.445:1	19.0	1.253:1
10.7	1.824:1	14.9	1.439:1	19.1	1.249:1
10.8	1.810:1	15.0	1.432:1	19.2	1.246:1
10.9	1.798:1	15.1	1.426:1	19.3	1.243:1
11.0	1.785:1	15.2	1.421:1	19.4	1.240:1
11.1	1.772:1	15.3	1.415:1	19.5	1.237:1
11.2	1.760:1	15.4	1.409:1	19.6	1.234:1
11.3	1.748:1	15.5	1.404:1	19.7	1.231:1
11.4	1.737:1	15.6	1.398:1	19.8	1.228:1
11.5	1.725:1	15.7	1.393:1	19.9	1.225:1
11.6	1.714:1	15.8	1.387:1	20.0	1.222:1
11.7	1.703:1	15.9	1.382:1	20.5	1.208:1
11.8	1.692:1	16.0	1.377:1	21.0	1.196:1
11.9	1.681:1	16.1	1.372:1	21.5	1.184:1
12.0	1.671:1	16.2	1.366:1	22.0	1.172:1
12.1	1.661:1	16.3	1.362:1	22.5	1.162:1
12.2	1.651:1	16.4	1.357:1	23.0	1.152:1
12.3	1.641:1	16.5	1.352:1	23.5	1.143:1
12.4	1.631:1	16.6	1.347:1	24.0	1.135:1
12.5	1.622:1	16.7	1.342:1	24.5	1.127:1
12.6	1.612:1	16.8	1.338:1	25.0	1.119:1
12.7	1.603:1	16.9	1.333:1	25.5	1.112:1
12.8	1.594:1	17.0	1.329:1	26.0	1.105:1
12.9	1.586:1	17.1	1.324:1	26.5	1.099:1
13.0	1.577:1	17.2	1.320:1	27.0	1.094:1
13.1	1.568:1	17.3	1.316:1	27.5	1.088:1
13.2	1.560:1	17.4	1.312:1	28.0	1.083:1
13.3	1.552:1	17.5	1.308:1	28.5	1.078:1
13.4	1.544:1	17.6	1.304:1	29.0	1.074:1
13.5	1.536:1	17.7	1.300:1	29.5	1.069:1
13.6	1.528:1	17.8	1.296:1	30.0	1.061:1

ABOUT THE AUTHOR

Jon C. Henning is currently employed by TX-RX Systems, INc. of Angola, NY. TX-RX is a multi-coupler and duplexer manufacturer. He started his employment as a production technician in 1979 and worked in that capacity for six years. During the past four years Jon has worked in the sales and marketing department. He is an avid ham radio operator and has had his license since 1969.

FOUR-CAVITY UHF BAND-PASS FILTER
CUT-AWAY VIEW

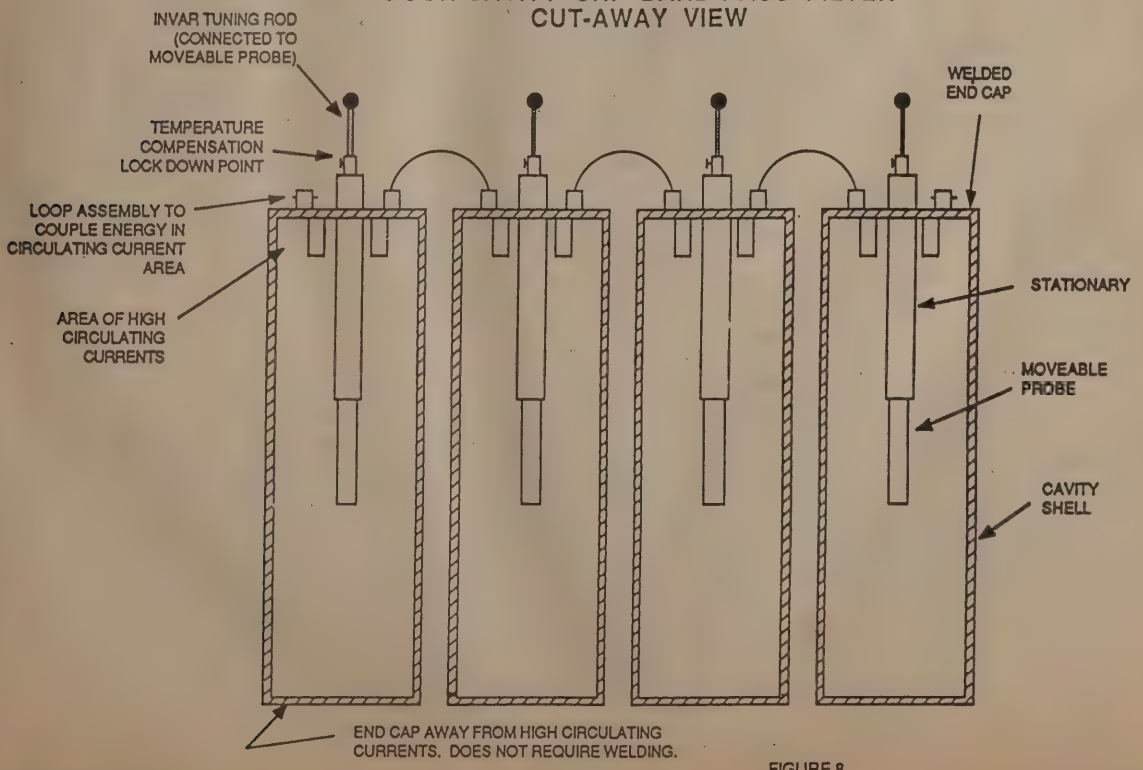
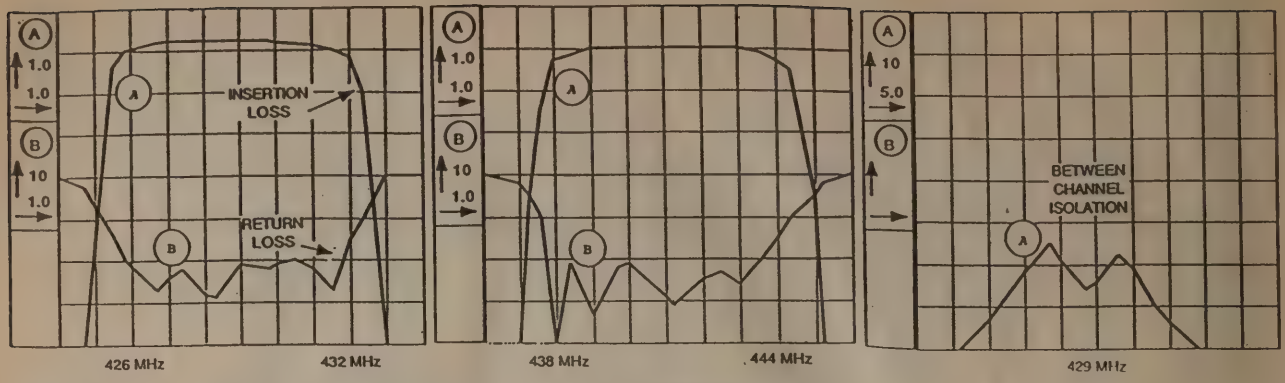
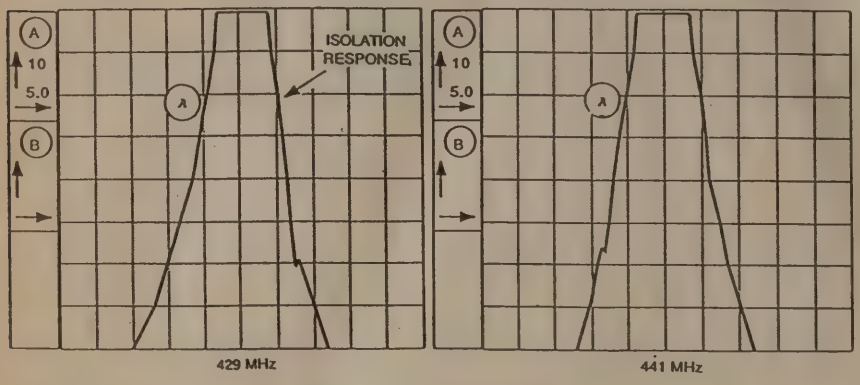

INVAR TUNING ROD (CONNECTED TO MOVEABLE PROBE)
TEMPERATURE COMPENSATION LOCK DOWN POINT
LOOP ASSEMBLY TO COUPLE ENERGY IN CIRCULATING CURRENT AREA
AREA OF HIGH CIRCULATING CURRENTS
WELDED END CAP
STATIONARY
MOVEABLE PROBE
CAVITY SHELL
END CAP AWAY FROM HIGH CIRCULATING CURRENTS. DOES NOT REQUIRE WELDING.

FIGURE 8

COMBLINE ATV DUPLEXER MODEL 26-66-87072





CURVE KEY

↑ = Vertical sensitivity in dB/div.

→ = Horizontal sensitivity in MHz/div.

Zero reference line is at the top of display for curve A, and horizontal centerline for B.

SEE FIGURE 3 FOR RETURN LOSS TO VSWR CONVERSION.

FIGURE 5

BETWEEN CHANNEL ISOLATION OF A NOTCH DUPLEXER

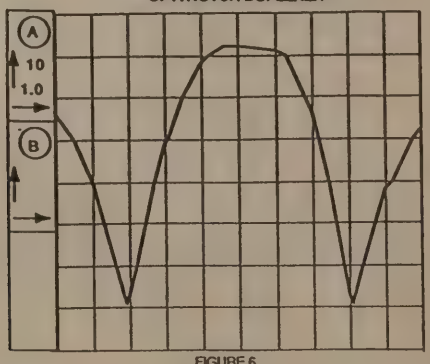


FIGURE 6

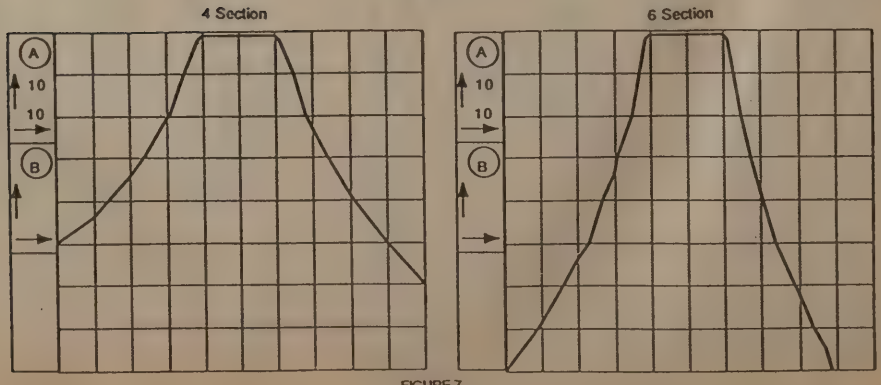


FIGURE 7

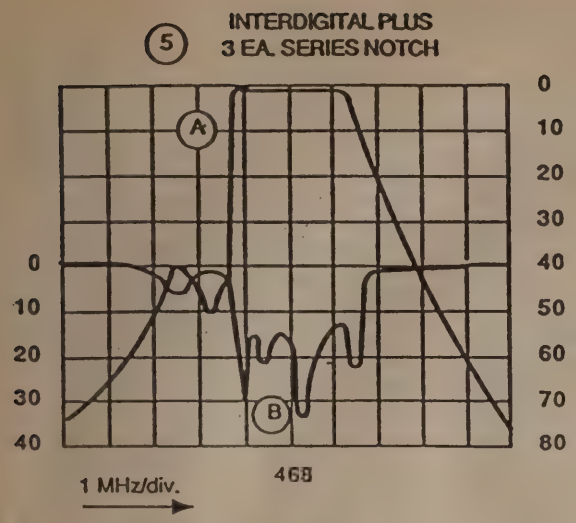


FIGURE 9A

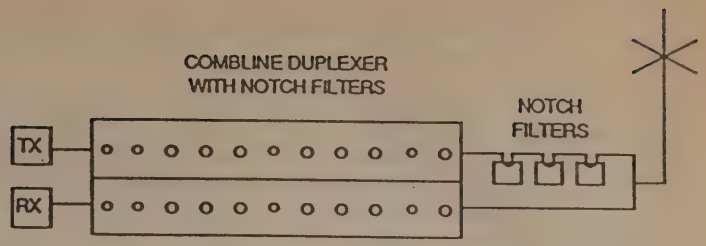


FIGURE 9B

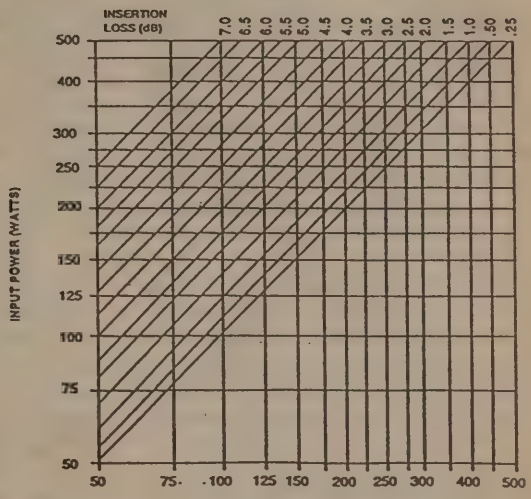
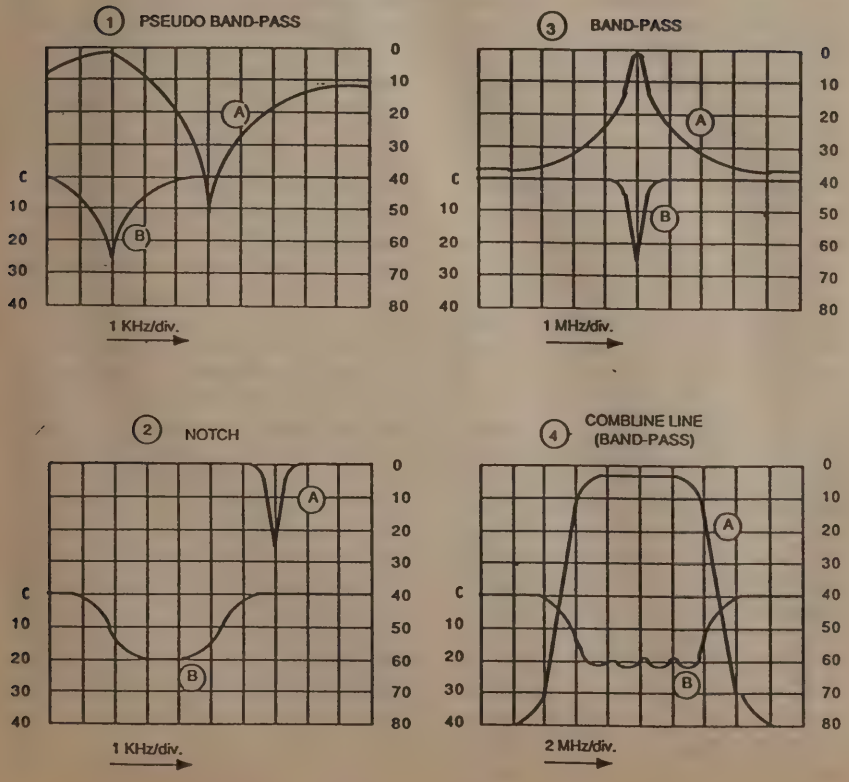


FIGURE 10

TYPICAL FILTER RESPONSE CURVES
(RESPONSES ARE HYPOTHETICAL)



CURVE A: ISOLATION RESPONSE
CURVE B: *RETURN LOSS RESPONSE

*SEE CONVERSION CHART - RETURN LOSS TO VSWR FOR CURVE B RESPONSES.

FIGURE 11

FINDING THE WAY THROUGH TV'S RESOLUTION MAZE

MARIO ORAZIO

Somewhere Out There...You might not have noticed that resolution seems to be the least understood aspect of television equipment specifications. I have.

It's ridiculous! Resolution is specified in terms of lines, line pairs, bandwidth, pixels and/or nanoseconds. Sometimes it's specified across a picture's width and sometimes from top to bottom, even when dealing with horizontal resolution.

Besides horizontal resolution, there are vertical resolution and diagonal resolution, each of which has static resolution and dynamic resolution. There's also temporal resolution.

For each of these resolutions, there are both luminance resolution and chrominance resolution, and even different chrominance resolutions for different colors.

And, even with all of that, a camera specified at 700 lines of resolutions looks better than a camera specified at 500 lines of resolution, even when both are viewed through a broadcast channel restricted to just 330 lines.

Now, I'm not saying I am the world's greatest expert on resolution, but I'll give you a few details that should help clarify matters a bit.

Clarifying Resolution. First, here are the most basic facts of horizontal resolution.

We broadcast 525 scanning lines per frame at about 30 frames per second. That means there are 15,734.26 scanning lines per second or about 63.5 us per scanning line. Take away about 11 us for the horizontal blanking interval, and you've got 52.5 us of active line time.

Looked at in video terms, every cycle of a sine wave can be said to consist of a bright line (the positive going peak) and a dark line (the negative going peak) and the transitions between them. Those two lines are referred to as two "T" lines of horizontal resolution.

There is exactly one cycle of a 1 MHz signal in 1 us. Therefore, there are 52.5 cycles of a 1 MHz signal in the active line time. Since there are two TV lines of resolution per cycle, there are 105 TV lines of resolution per MHz per active scanning line.

Television pictures are 0.75 times as high as they are wide, and it would be nice to measure resolution the same way in both the vertical and horizontal directions. Therefore, there are 78.75 (105X.75) TV lines of resolution per MHz per picture height in an active scanning line.

We are allowed to broadcast only 4.2 MHz. Therefore, there are a maximum of 330.75 TV lines of horizontal resolution per picture height for US broadcast television.

If you look at a properly scanned resolution chart, you won't be able to make out more than 330 lines on the vertical wedges. Yes, horizontal resolution is measured with vertical lines.

The Vertical Picture.

Now for vertical resolution.

We still have 525 scanning lines, but 41.5 go to the vertical blanking intervals, so we are left with 483.5 active scanning lines. Here is where it gets tricky.

Even analog television signals are sampled vertically by the scanning lines. In a sampled system, the highest recoverable frequency is no more than one half the sampling rate, less filter losses.

The filters in an analog television system include the shape of the electron beam spot, which straddles more than one scanning line at a time.

We're lucky to have this filtering. If we didn't, and you shot a grid of 483.5 alternating white and black horizontal lines, you might see the lines when the camera was pointed a certain way, but you'd see nothing but grey if it titled up or down, by half a scanning line. Without filtering, the lines would flash on and off as the camera tilted.

If the Kell Factor is 0.684 (somewhere around the generally accepted range), then vertical resolution is 330.75 lines, exactly the same as horizontal resolution, which is a good idea, since studies have shown that human vision has a hard time dealing with unmatched horizontal and vertical resolutions.

Unfortunately, besides the Kell Factor, there is another loss in vertical resolution caused by the fact that we broadcast interlaced scanning liens. The interlace coefficient seems to be in the range of 0.6 to 0.7, yielding a vertical resolution (if the Kell Factor is 0.68) of only 200 to 230 lines.

That is where vertical and horizontal static (unmoving image) resolution figures come from, and they are both correctly measured in TV lines per picture height. I've already explained the relationship between bandwidth and TV lines PPH (78.75 TV lines PH/MHz). Now I'll tackle nanoseconds, pixels and line pairs.

Pixels and Line Pairs

In a 4.2 MHz signal, each cycle lasts 238 ns. Since each cycle contains a bright line and a dark line, each line lasts just 119 ns. Looked at another way, the fastest a signal can rise from dark to light is 119 ns. This can be called the fastest rise time.

Two hundred thirty-eight nanoseconds goes into 52.5 us (active line time) 441 times, so some say there are 441 pixels (picture elements, also sometimes cels) across the screen. That's exactly consistent with diving a resolution of 330.75 TVL/PPH by 0.75 (the aspect ratio).

Computers claim resolutions of 640 pixels across the screen, so they might, at first glance, seem to have much greater resolution than television pictures. Yet good TV character generators make better looking characters than computers.

TV character generators specify their resolutions in figures much lower than 119 ns -- Quantel's Cypher specifies better than 1 ns edge resolution, the seeming equivalent of over 1 GHz of bandwidth, or more than 238 4.2 MHz TV signals.

The secret is positioning. Com-

puters are stuck with fixed positions for their 640 pixels. TV might have only 441, but they can be placed anywhere along the line.

Quantel's 1 ns edge resolution means that a character edge can be positioned accurately to any of 52,500 different positions on a line, but its rise time will still be no faster than 119 ns (it better not be; if it is, your viewers might hear sync buzz).

That;s why TV characters look better than computer characters. They can be positioned (or shaped) up to 82 times better. (Not every character generator offers 1 ns resolution, but even 35 ns resolution is more than twice as good as a computer's 82 ns).

Line pairs are used to measure film (and sometimes lens) resolution. They are an indication of how close together a pair of lines can get before they cannot be distinguished as individual lines. That is exactly what you look at when you read resolution off a TV chart, except that TV cheats by claiming a white line and a black line as two lines, whereas for TV lines equals two film line pairs.

Film cheats, too. Its resolution is usually measured off a stationary piece of film, so it suffers none of the unsteadiness of a typical projection gate.

DYNAMIC RESOLUTION

That brings me to dynamic resolution, which is resolution in space (horizontal, vertical and diagonal resolution) when things are moving.

Outerlaced scanning takes a lot away from our dynamic resolution. Look at the output of a character generator when it's in a roll mode; the characters have only half the vertical resolution. That's interlaced scanning.

You can also freeze a frame of horizontal motion to see what interlaced scanning does to that. Some TV devices have even worse dynamic resolution problems, however, including a log of the schemes that compress high definition signals into narrow channels. Shutters are added to cameras to improve their dynamic resolution.

Spatial resolution, whether it is dynamic or static, includes not only horizontal and vertical resolution, but also diagonal.

Since diagonal resolution is a result (in NTSC, anyway) of horizontal and vertical resolution, it is actually 1.4 times greater than its parents (derived from Pythagoras' law of hypotenuses).

Thus, 330.75 lines becomes 467.75 lines diagonally. The funny thing is that human vision seems to work exactly the opposite way. To match 331 lines of vertical or horizontal resolution, we seem to need only 234 lines of diagonal resolution--half of what we have now. Several advanced television schemes take advantage of this discrepancy.

TEMPORAL RESOLUTION

Then there's temporal resolution, not to be confused with dynamic resolution, which is spatial. Again, even analog television signals are sampled in time (by thee field and frame rates)1 and therefore, again, they need to be filtered.

Unfortunately, the only temporal filter we have is poor dynamic resolution. Film rarely offers even that, which is why you get to see wagon wheels and aircraft propellers moving backwards (examples of a temporal alias).

Drs. Bill and Karen Glenn of New York Tech in Florida have shown that we cannot simultaneously perceive high temporal and high spatial resolution, a factor used in their and other HDTV systems.

Finally (for this article), there's color. Human vision requires less detail in color than it does in brightness, which is why FCC regulations call for 1.3 MHz of bandwidth in the I component and 0.6 MHz in the Q, translating to 102 and 47 TV lines per picture height of static horizontal resolution, respectively.

MINDING YOUR I'S AND Q'S

We need more resolution in I (and the I axis is rotated 33 deg. from R-y) because we see detail in reddish colors along the I axis somewhat better than we do in blues. Yet, the number of TV models that offered full I resolution in the 35-year history of NTSC color can be counted on the fingers of one hand.

Vertical chroma resolution is another matter. To avoid interference between chrominance and luminance signals, we need filtering.

A simple luminance ow-pass filter restricts horizontal resolution to 3 MHz or 236 lines (that's where the 240 line resolution of color-under recorders comes from).

To get more luminance resolution, we use comb filters, but these restrict vertical chrominance resolution--not necessarily a bad idea, considering the desire to come close to matching vertical and horizontal resolutions.

None of this explains why a 700 line camera looks better than a 500 line camera looks better than a 500 line camera through a 330 line transmitter. That's because everything I've explained to this point refers only to maximum or limiting resolution, which is a number.

Real-world resolution is a function, which can be graphed as contrast versus detail. This "modulation transfer function" falls off from zero detail in a curve with a Gaussian or sine X/X shape;, depending on the devices being used.

Either way, the farther out the limiting resolution, the greater the contrast at 330 lines than does a 500 line camera, even though both will be restricted to 330 lines by your transmitter's roofing filter.

Understand it all? Of course you do. Horizontal resolution is measured with vertical lines and vice versa. Diagonal resolution might be twice what it has to be. Computers sometimes have better resolution than TV and sometimes don't.

Dynamic resolution allows sharp still frames but makes wagon wheels turn backwards. Red lips need more detail than blue eyes. And 330 lines still lets 700 lines look better than 500 lines. It's all perfectly clear.

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TV Technology Jan. 89.

ATV Q & A

By Tom O'Hara, W6ORG

Thanks for your calls and letters with questions and comments from the first issue of ATVQ - keep them coming. The only dumb question is the one you didn't ask!

This quarters emphasis will be on receiving ATV. However, the comments and further questions generated by the last issues emphasis on transmitting and adding linear amps will be covered at the end under "Q & A Feedback".

HOW FAR DOES ATV GO AND CAN I GET A GOOD PICTURE FROM THE REPEATER X MILES AWAY?

This is the most asked question by those thinking about getting into ATV and are considering just getting a downconverter to try it out. I suspect all you long time ATVers also hear it when you talk about ATV to newcomers on the air or radio club.

There is no pat answer since each condition has so many variables. The line of sight DX can be calculated if easily measured parameters are known. See the path loss Basic program in this issue. With the non line of sight condition, there are so many unmeasurable variables that one just has to try it to find out.

As to "how far does ATV go" it is more of a question of how much energy is left at the end of a non line of sight path, and your receive systems noise figure and bandwidth.

Unless you can cut down all the trees, level the hills, etc. to give you a line of sight path, I suggest putting your money and time in the best and highest antenna and feedline system you can afford. This will pay off both in receive and transmit.

If you had a perfectly flat ground path, and your antenna was at 50 ft., your RF horizon would be at 10 miles. Therefore you would have a near free space path to another station also with a 50 ft. antenna height up to 20 miles.

So you could put in a snow free picture to this station with just 1 watt also assuming 3 dB loss in coax, 14 dBd beams, 3 dB system noise figure and TV luminance bandwidth of 3 MHz. I am defining snow free as 40 dB signal to noise ratio which is all about what our home entertainment cameras and VCR's can do anyway. Peak sync in most TV sets for snow free is around 200 microvolts. Broadcast calls 55 dB snow free, but that is like the case of the super $$$ digital stereo audio system being played into a small portable transistor radio speaker.

IF ONE PREAMP IS GOOD THEN 2 HAS TO BE EVEN BETTER, RIGHT?

Not always true intermod breath! Front end gain should only determine the system noise figure, not it's gain. Preamps are usually designed for lowest noise figure and sufficient gain (12 - 15 dB) so that the noise figure of the following stage contributes little to the total system noise figure.

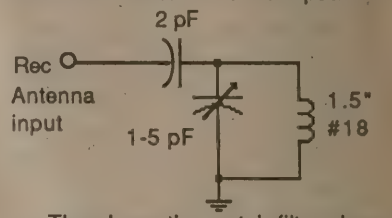
These preamps usually have very broad bandwidth and as such amplify not only the desired ATV signal but strong FM amateur and commercial repeaters, and worst of all, UHF TV stations. If any of the signal levels reach the dynamic range limits of *any* of the receiver stages, they will mix and their products may fall right in the desired ATV passband.

The best rule of thumb when selecting devices for preamps with good noise figure for high intermod areas is the 1 dB compression point. Generally with devices designed for very low noise figures (<2 dB), bipolar transistor 1 dB compression points are about -20 dBm, dual gate GaAsfets Ø dBm, and single gate GaAsfets +12 dBm. Ø dBm = 1 mW.

UHF TV stations can have effective radiated powers of up to 5 *Megawatts*. Most preamps, downconverters, and TV tuners probably won't have the selectivity to sufficiently reject the undesired signal. Adding a preamp to an existing IM interference situation without also adding some selectivity will only aggravate the situation.

You can add selectivity with low insertion loss bandpass or notch filters just after the first preamp without noticeable change in sensitivity. If that doesn't do it, you need more selectivity or your preamp is being hit too hard past it's 1 dB compression point and the filtering will have to be put in the antenna line. In this case the insertion loss will directly affect the sensitivity.

A very simple low insertion loss method with a single known IM source such as a strong UHF TV station is an absorption notch filter at the preamp or downconverter antenna input.



The absorption notch filter shown here has a 25 dB notch when tuned to channel 14 (471 MHz) and only .5 dB loss at 439 MHz. It consists of a 1-5 pF variable cap tuning a parallel 1.5 " long hair pin loop .5" wide of #18 buss, and coupled to the 50 ohm receive coax antenna input with a 2 pF cap. 1 pF gives a 10 dB notch.

Set the cap to minimum capacity. Tune in the ATV frequency that has the interference. Then slowly increase the variable capacitor tuning to the point that minimizes the interference from the strong UHF TV channel.

Do not put this in the transmit line as mistuning could cause problems with your transmitter. You can put it right on the downconverter board antenna input or receive output of the RF T/R relay board. The 2 pF cap must have leads no longer than 1/8".

Other causes of intermods can be contaminated coax and connectors, rusted antenna joints, and other transmitters in the area.

HOW THEN DO I KNOW IF I HAVE ENOUGH OR TOO MUCH GAIN?

The right amount of gain is that which just starts to pump up the video IF's AGC on noise. The gain and bandwidth are going to vary from TV to TV as well as the added downconverter/preamp combo. The price, manufacturer or model of TV is not always a good indicator. You can check this out by putting a voltmeter (isolated from the AC line to prevent

shock from a hot chassis TV - battery type VOM suggested) on the Video IF AGC test point. Make sure it is the video IF TP and not the RF or delayed AGC TP. You might want to leave an inexpensive voltmeter connected as an S-meter.

With the ATV downconverter connected but turned off, fine tune to channel 3 or the open channel you are using for all snow or minimum adjacent channel interference. This is the no signal IF AGC voltage. Then turn on the downconverter. Tune the downconverter frequency also to a no signal point with the ATV antenna disconnected or input shorted. If the AGC voltage changes then your gain may be a little too high.

If the downconverter does not contain a low noise preamp stage (<1.5 dB), you can try adding a good quality preamp as long as it does not pump up the AGC voltage. If it does pump it up you might consider replacing the downconverter with one containing a better preamp device. If you are not in an area with high intermod possibilities you can add a preamp even though the AGC might get pumped up a bit, but keep in mind that the amount of extra gain above the noise floor will cut into your strong signal handling capability.

Antenna mounting a good preamp is always preferred for best sensitivity since it eliminates the feedline loss, again assuming you have enough system gain to just get you to the noise floor (the video IF AGC test again). I suggest running Belden 9913 coax (2.5 dB/100' loss) for up to 75' and hard line after that. If your feedline loss exceeds 2 dB, and new preamps noise figure is better by more than 1 dB, then with the antenna mounted preamp you will see a difference.

Most TV sets I have tested need 15 to 25 dB at most to get to it's bandwidth noise floor. Adding another 15 dB gain preamp at the shack to a downconverter with 15-25 dB gain will start pumping up the TV AGC on noise. But mounting the same preamp at the antenna will actually improve the dynamic range by decreasing the added preamp gain as seen at the downconverter input due to the coax loss.

I have tested the Advanced Receiver Research (call 203-5840776 for info) RF switched antenna mounted MML432VDG preamp with good results. There are others on the market now that should do as well. However make sure they will handle the RF transmit power of your transmitter at it's output. The MML432VDG handles up to 160 watts and has a noise figure of <.6 dB. The SP432VDG takes up to 25 watts.

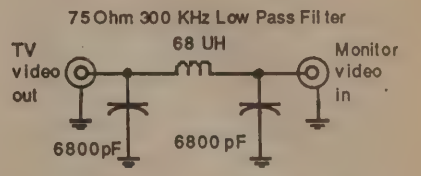
OK I'M JUST BARELY PUMPING UP THE AGC ON THE NOISE FLOOR WITH MY ANTENNA MOUNTED PREAMP, BUT I WANT A LITTLE BIT MORE SENSITIVITY FOR THE DX OPENINGS. IS THERE ANYTHING I CAN DO WITHOUT ALSO INCREASING THE PROBABILITY OF INTERFERENCE FROM STRONG SIGNALS?

Yes there are two things you can do. One trick is to reduce the bandwidth, thereby lowering the noise floor. Given standard temperature, system bandwidth, noise figure and sufficient gain to get you there, the noise floor can be calculated. For a 3 MHz bandwidth and a total system noise figure of around 2 dB the noise floor is going to be about 1 microvolt (-107 dBm). The luminance 3 dB bandwidth in the average TV set is around 3 MHz.

To lower the noise floor, you simply reduce the bandwidth. It is a direct power relationship. In other words if you reduce the bandwidth by a factor of 10 to 300 KHz, you also reduce the noise floor 10 dB. So if you put a 300 KHz wide channel 3 bandpass filter followed by an in-line amp to make up for the 10 dB lower noise floor and the filter insertion loss, you can gain 10 dB more sensitivity.

Ah Ha you say, what happens to the video? You do end up with little or no color and sound subcarriers and low resolution black and white video. But for DX and seeing the call letter card what's the difference, it will bring it out of the snow. 300 KHz roll off is not too low to affect the horizontal sync lock up.

But you want it all? Well you can also do the same thing with a 75 ohm low pass 300 KHz filter between your primary color TV set, if it also has a video output jack, and a video monitor. That way you can see the weak snowy video or sync bars to identify and peak the antenna on with the black and white monitor, and then see the stronger signals on the color TV.



The other thing you can do is what weak signal contesters have known for along time and that is that stacked antenna gain seems to work better than a single long antenna of the same gain. Theoretically you can get 3 dB more gain every time you double the size of your antenna system. In practice you can expect 2 to 2.5 if everything is right. So this says that running a pair of KLM 440-6X antennas would have about the same total gain as a single 440-10X. The dual antenna seems to suck in the signals better however. Going from one antenna to a stacked pair will increase your DX up to a factor of 1.4 times for the same picture.

It could be that it is better to have two points in space receiving the signal rather than one. We do know that with a single antenna in a multipath ghost condition, moving the antenna a few inches one way or the other puts you in or out of the null. So with the dual antenna, if one of them is going through a null, the other one may not be.

Stacking the two antennas one above the other gives you the increased gain but does not narrow the horizontal beamwidth or antenna rotation sharpness. If you stack side by side it does make it sharper. This is regardless of the antenna polarity. Spacing for the KLM440-27's is 5' - 6" for one above the other, and 6' - 2" side by side.

WHAT IS THE BEST ANTENNA FOR ATV, AND DQ I MOUNT IT VERTICAL OR HORIZONTAL?

A U.S. Army study showed that above 300 MHz a case could not be made for one polarity always being superior to another. Polarity is a regional decision usually made by those who are first on and what they

already have up. For newcomers I suggest finding out from those around you before bolting yours in place. Cross polarity can cost you 20 dB. One way around it is to use circular polarization as the satellite people do so that you can communicate with either polarity and any other mode in the band. Most repeaters are vertical and most DXers are horizontal.

Antennas are always a subject of discussion because there are again so many variables and conditions. Besides high gain you also need the bandwidth for the frequency(s) and upper vestigial side band to go through without rolling off. Worst case on 70cm is an area with a 439.25 in/ 421.25 out repeater. The antenna then must cover 420- 444 MHz with reasonably flat gain, and low VSWR at your transmitters frequency.

Most high gain Yagi type antennas are not wideband (1% band width) unless the designer does some thing like making the elements large in diameter or driving multiple elements at a sacrifice of a little optimum gain. The 15 element Quagi in the ARRL Handbook is an excellent home brew antenna if the material and lengths are followed to the letter. Bandwidth is about 15 MHz and should be cut or scaled for your transmit frequency. The roll off at the bottom end of the band to receive the repeater is of less importance than having radiation from VSWR getting into things.

The most popular commercial antennas designed for good gain and full 70 cm wide bandwidth suitable for ATV are the 88 element J Beam and the 27 element KLM. Both are 12 ft long. The J beam gets it's bandwidth with a Quagi type driven element and 4 director elements in an X pattern at each boom location. The KLM 440-27 has 4 driven elements. I have seen both of these measure 14 dBd at antenna measuring contests.

I encourage more participation by ATVers in the VHF/UHF antenna measuring contests that are held at Dayton and the regional VHF/UHF conferences in the spring and summer every year. This is a chance to see what different antennas *really* do and to talk directly with the builders and designers.

This year at Dayton the antenna measuring contest will again be run by Joe Burke, WA8OGS, on Sunday morning. All antenna's, home brew and commercial, are welcome. So bring yours from home, buy one Saturday and put it together in your room that night, or just show up to kibitz. Joe will also be the moderator for the VHF/UHF Forum Saturday morning, 0900-1230 in room 5, which will include preamp measuring.

At the antenna measuring contests you will see smiles on those that get near their expected gain, and tears and sour grapes from those that don't. These events are usually run by knowledgeable people with equipment and locations that give results within a dB or so. Most use the NBS Yagi for a reference which is a very repeatably built antenna of known gain.

But even if you might nit pick (it's expected from the aficionado's) at the actual gain figures and set up, there are enough well known antennas measured that good comparisons can be made. And if your particular antenna doesn't live up to your expectations, there will be at least 10 self styled experts on hand to tell you how to make it better. It's really a lot of fun.

There are some unusual types too that might surprise you. I once saw at the West Coast UHF Conference a guy throw one together with a metal fish pale and quarter wave 23 cm spike inside. He made two measurements: 8 dBd without and 7 dBd with the fish in it. Another used a trash can lid as a reflector and did surprisingly well.

Come prepared to mate to a Type N male coax connector or take the loss of their adaptors. Frequency is usually at the weak signal part of the band: 432, 903, 1296, 2304, etc. This should not be a problem with our broad band ATV antennas even though a little off. Gain bandwidth is usually much wider than VSWR bandwidth, and it is your built in excuse if you are off a few dB's.

MY TV HAS TO BE TUNED FOR EITHER BEST PICTURE OR BEST SOUND, BUT ANOTHER ATVER RECEIVING THE SAME SIGNAL DOES NOT, HOW COME?

I keep hearing this from time to time, and it was mentioned in a recent Ham Radio Magazine article. The article supposed it was caused by the double sideband pushing the AFC off to one side. But this doesn't make sense to me since these same TV's have the problem with the AFC off, and the AFC's discriminators I am familiar with are less than 1 MHz wide and are sync keyed.

I would like to hear from those that consistently have this problem from a number of ATV transmitters with a description of the signal strengths involved and a copy of their TV's schematic. Maybe we can come up with a good repeatable scientific answer.

None of my TV sets have the problem so I have never been able to recreate the situation. But I suspect the problem is a poor IF bandpass or little or no sound IF limiting. If that is the case then both subcarrier sidebands are arriving at the FM detector with about the same amplitude and canceling. Detuning to one side decreases the amplitude of one of the sidebands and the sound returns at the expense of the video.

One way to prove this out and solve the problem in these sets is to suck out the lower sideband sound subcarrier. This can be done with an absorption trap in the channel 3 output 75 ohm coax tuned to attenuate 56.75 MHz (ch3 - 4.5). The simple filter shown has an 18 dB notch and 3 dB down +/- 1 MHz. Insertion loss is negligible +4.5 MHz.

Even if you do not have the best sound or best picture situation this trap can help suck out strong adjacent channel VHF TV signals, amateur FM repeaters, links, etc.

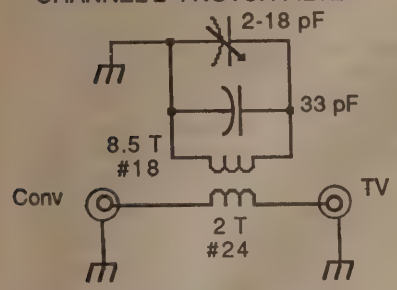
The 8.5 turn coil is made by winding the #18 buss wire around a 1/4-20 screw as a form, and then unscrewing it. The 2 turn link is wrapped around the coil with insulated #24 hook-up wire. Paralleling a 2-18 pF tuning cap with a 33 pF (40 pF total) will tune thru the resonant frequency with some resolution. All should be mounted in a small shielded box with F connectors no more than 2" apart.

Set the cap for maximum capacity. Tune in an ATV station with a color or P3 or better signal for best picture. With the transmitting station giving you a test count, slowly decrease the tuning capacitor to the point where the sound improves, then peak it.

For just outside of the ATV channel interference, tune in the

desired ATV station with the downconverter, and then tune the trap cap to the point where the interference is minimized.

CHANNEL 2-4 NOTCH FILTER



MY TWO METER TRANSMITTER WIPES OUT THE 70CM VIDEO, CAN IT BE FILTERED OUT?

The 2 meter interference can be from two different causes. If the 3rd harmonic of your 2 meter rig falls in the passband of the ATV signal, it is most difficult to get rid of. You can filter it but your downconverter and or two meter transmitter may not be shielded enough. The best thing to do is to select your local ATV coordination frequency on two meters to not have a 3rd harmonic in the passband. 144.34 is fine for 439.25 but not for 434.0, and 146.430 is vice-versa.

A low pass filter in the 2 meter antenna coax line will kill the 3rd harmonic before it's radiated. The low pass filters are available from Spectrum International or use one of the low cost mobile antenna duplexers used with one of the 2 antenna output dual band FM rigs.

Actually I run my 50 watt 434 ATV and 25 watt 146.43 transceivers to the Kenwood MA700 duplexer and dual band mobile antenna system on my Motorhome. I can transmit on either of them with no trace of the other in the receiver. The antenna gives 3 dB on 2 meters and 5.5 dB on 70cm. I recommend this for public service work to minimize the number of antennas and coax you need and at the same time have the filtering. Larson and NCG Co. also have 2m/70 cm duplexers for under $60.

The duplexers have hardly any insertion loss as they are highpass/lowpass filters with about 50 dB of isolation. The 70 cm high pass section also cuts the amount of front end overload from the two meters into the ATV downconverter or preamp. You can do the same thing with antenna separation. I suggest at least 10 ft driven element end to end separation between antennas for 10 watt 2 meter rigs and add a foot for each watt above 10.

Do not bundle all your coaxes as it increases crosstalk coupling from any leakage or VSWR . Tape them to opposite sides of the tower.

HOW MUCH ANTENNA SEPARATION AND/OR FILTERING DO I NEED TO RUN DUPLEX ATV WITH MY 70 CM RIG AND ONE ON 33 OR 23 CM?

Again, watch the harmonic relationships. There should be no problem with 434.0 and 439.25, but 426.25 can wipe out 1277.25 and maybe 1289.25. I suggest 10 ft driven element end to end separation between 70 and 33 cm antennas minimum, and 7 ft 70 cm and 23 cm.

The nice thing about crossband duplex or repeat is that it does not take any additional filtering if attention is paid to antenna positioning. If you are running higher power or seeing some desense, you can try moving one of the antennas back and forth on the mast to find the "magic point" nulls and then clamp it in place.

This trick is often done on emergency vehicles with multiple transceivers and antennas. A spectrum analyzer or communications monitor is connected to the coax from the antenna to be added but tuned to receive the existing transmitters frequency. A sig gen on the existing transmitter frequency is then transmitted out on the old antenna. The new antenna is then moved around on top of the roof until the minimum pick up point is found.

FULL DUPLEX AUDIO ON ATV WITH THE SUBCARRIER AND TWO METERS OR ANOTHER ATV STATION ON 33 OR 23 CM IS GREAT BUT HOW DO YOU PREVENT THE AUDIO FEEDBACK?

Most camera mics and low impedance dynamic mics are omni directional. They pick up the kids fighting in the next room as well as yourself and your two meter or TV sets speaker. If you turn the gain up on the speaker to hear the other stations or your mic gain to be heard, feedback will result.

In these cases you could turn the mic gain down low and close talk the mic or use ear phones. But this seems to negate the advantage of full duplex audio, and you sure would not do it with the public when doing a public service event like a remote Santa Claus at childrens hospitals, etc.

I use a Radio Shack 33-986A unidirectional mic with phone to minijack adaptor plugged into my TX23 transmitter for duplex operation at public service events. As long as I don't point it directly at the TV or 2 meter speaker I don't get feedback. If you place the TV set and 2 meter rig or it's remote speaker behind the camera, you will be seen as talking and listening directly to the person you are facing. The directional mic can be fastened to the camera with it's rear toward the TV speaker, or if hand held you just have to remember not to aim it directly at the camera.

****

Give me a call or drop a note with your technical questions, or let us know some of the solutions you have found so they can be passed on to the rest of the gang. Come by booth 358 at Dayton and say hi - the 11th year for MaryAnn and I- and we will be running full duplex ATV with Bill, WB8ELK in the ATVQ booth, 361.

The **Dayton ATV Forum** will start Saturday at 2:45 in room 3. I'll be giving the ATV basics and Q & A for the newcomers plus what seems to be the trends in ATV...duplex, repeaters and linking.

We have Bob Rau, N8IYD, who will show and tell about running ATV from his high powered 100" long 7 Lb Rocket - matches will be confiscated at the door.

Also David Pacholok, KA9BYI, will demonstrate his 250 watt ATV transmitter he put together for under $200 using a microwave oven.

CU AT DAYTON, TOM, W6ORGy
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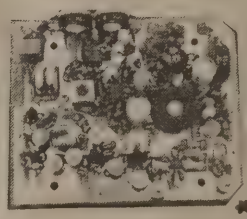
TOM (W6ORG) & MARYANN (WB6YSS) O'HARA (818) 447-4565

THE "KREEPIE PEEPIE" ATV TRANSMITTER

1. 1.5 watts typical output on sync tip (@13.8 vdc) matches 15 & 50 watt amps for full linear output.
2. Now you can see your own transmitted video with the on-board RF detector/monitor 1 v output.
3. Final RF output test point for setting up blanking pedistal with a DC voltmeter.
4. Improved lower distortion subcarrier sound generator for cleaner audio and 4.5 mHz stability.
5. All this at no increase in price! Single freq. KPA5-E board still $159* delivered*. Two freq. $174.*

TX70-1 READY TO GO ATV TRANSMITTER contains the KPA5-E & TR-10 T/R relay in a small 6x5.2x2.5" shielded cabinet. Same xmit functions as the TC70-1 including both the 10 pin "VHS" camera & RCA phono jack video/audio inputs. If you are one of those who started with just a downconverter, saw some pictures and was bitten by the ATV bug, then this ATV transmitter is for you - just connect its input to the downconverter BNC connector on the back of the TX70-1.

TX70-1 *$239 DELIVERED



KPA5-E board still only $159

* UNTIL MAY 1, 89 PRICES GO UP A LITTLE.

KPA5 70CM ATV XMTR BOARD FEATURES:

- >1 WATT P.E.P. RF OUTPUT ON SYNC TIP. Run barefoot for portable. Output properly matches Mirage D15N, RFC4-32 15 watt or D26N-ATV 50 watt linear amp for full output and the Mirage D1010N-ATV to over 50 watts
- FULL COLOR AND SOUND on a small 3.25x4" board
- Wired and tested board runs on external 13.8vdc @ 300ma. supply or 12 V battery
- Accepts composite video from cameras, camcorders, VCRs, computers, etc.
- 2 audio inputs, one for low Z dynamic mic, & one line level from most cameras & VCRs
- Supplied with one xtal on 426.25, 434.0, or 439.25. 2nd xtal add $15. Specify freq. when ordering, check with local ATVers, ARRL Repeater Directory or call us. Only 2 channels available in any given area due to video bandwidth of 9.1 mHz.
- * **Price still $159 delivered** via UPS surface in contiguous USA. Transmitters sold only to licensed Technician class or higher amateurs for legal purposes. We verify name, call letters, & QTH in the Callbook. If recently licensed or upgraded send a copy with order.

KPA5 APPLICATIONS:

PORTABLE CORDLESS TV CAMERA. Think of it as a video HT. Place the KPA5 in one of the Hammond Dicast aluminum boxes, AEA HR-4 half wave "hot rod" on top or at the end of 50Ω coax attached to a headset. Plug into a 12-14 v source such as the Radio Shack 12v 5Ah battery power pack (23-182). Depending on terrain & receiving antenna DX is typically over 1 mile. With KLM 440-27s at both ends DX is 22 miles snow-free line-of-sight.

- Transmit the video to a remote VCR rather than lug it.
- Great for public service events: marathons, parades, damage assessment, search & rescue, CAP, etc.
- Mount in a R/C airplane, rocket, balloon, or robot to enable remote control when the vehicle is out of sight.
- Put it in your own cabinet for base, portable or mobile. When more power is needed, connect to one of the Mirage or RF Concepts amps listed below.
- Put a KPA5 in a dicast box with a VOR (video operated relay) to make a hill-top video repeater. Repeat other ATVers, weather radar or Space Shuttle video.

WHAT IS REQUIRED FOR A COMPLETE OPERATING SYSTEM? A **TVC-2G, TVC-4G** or **TVCX-70** downconverter connected to any TV set or VCR tuner tuned to an open channel of 2, 3 or 4, and coax cable to a good 70cm antenna to receive. Connect up the **TX70-1** or package up the KPA5, add 12 to 14 vdc, antenna, and any home video camera, camcorder, VCR, or computer with composite video output and you are on the air. **IT'S THAT EASY!**

ACCESSORIES:

TVC-2G GaAsfet downconv. board wired & tested....$49
varicap tuned, 420-450 MHZ to ch3. Req 12vdc
TVC-4G (TVC-2G in cabinet with 120vac supply).....$89
TVCX-70 crystal controlled GaAsfet downconv.....$99
specify in freq. & out on ch 3 or 45mhz IF. 2 freq.....$114
Hammond 1590D Use for KPA5. 7.3x4.7x2".....$17
1590C 4.6x3.6x2" aluminum box. Fits TVCX-70.....$11
800J 10 pin VHS color camera chassis connector.....$10
VOR Video (horiz sync) operated relay board.....$25

MIRAGE D15N-ATV 1in /15 out all mode amp.....$149
RF CONCEPTS rfc4-32 15w + GaAsfet preamp.$155
MIRAGE D26N-ATV 1in / 50 out all mode amp....$209
AEA HR-4 "Hot Rod" half-wave portable antenna.....$23
450 ISOPOLE omni 4dDd vert. gain antenna.....$65
KLM 440-6X 8.9dDd ant., 28" boom, >50 deg BW....$51
KLM 440-10X 11.2dDd, antenna, 64" boom.....$65
KLM 440-27 14dDd, 36 deg. BW antenna.....$107
UG21 type N male connector for larger ID coax.....$5

2/89

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TOM (W6ORG) & MARYANN (WB6YSS) O'HARA (818) 447-4565

NEW FROM P.C.

SEE THEM ALL AT OUR BOOTH, #358, AT DAYTON

Crossband full duplex with 70 cm or repeat using 33 or 23 cm is the next advancement in ATV, and we have made it easy for you. It's as simple as adding another downconverter or transmitter and antenna to transmit and receive simultaneously. Besides seeing and talking to each other at the same time, you can also use one of the other bands for your own remote link or repeater as is done at the Rose Parade. Make a crossband repeater with 2 antennas, bandpass filters, select one of the ATVR receivers and RTX transmitters, add VOR board and 13.8 V.

NEW 1 WATT ATV TRANSMITTERS:

TX-33 910.25 MHz.....$299
TX-23 1289.25 MHz.....$299

Both models have a > 1 watt p.e.p. output with adjustable blanking pedestal for proper adjustment when driving the Downeast 18 watt or other amps. Built-in T/R relay with BNC output to companion TVC-xG down-conv. Independent volume controls for mic and line audio. Push-to-look. 10 pin VHS camera jack plus video & audio input RCA phono jacks on back for any other camera, camcorder, VCR or computer switch selectable from the front panel. Video monitor output has actual detected modulation in transmit for accurate adjustment of video gain, & camera video in receive.

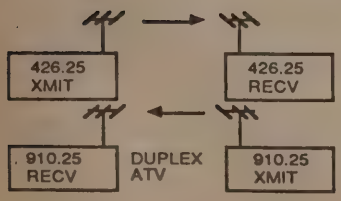
Requires 13.8 Vdc @ .5 amps + camera current.

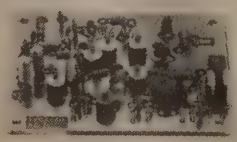
RTX-33 923.25 MHz.....$299
RTX-23 1253.25 MHz.....$299

Same transmitter board as the TX-33 and TX-23 put in a 1590D Hammond Diecast aluminum box without T/R relay and VHS camera connector for dedicated repeater and link applications.

NEW ATV RECEIVERS AND CRYSTAL CONTROLLED DOWNCONVERTERS

Now you have your choice of TV set or video monitor output of ATV from 70, 33, or 23 cm. We have added a crystal downconverter for the 23 cm band to our line and put it or the 33 or 70 cm versions in a 1590D box with our VRC45 receiver. This makes the other half of building a repeater or dedicated link easier. All our downconverters have a GaAsfet preamp and mixer for best noise figure and dynamic range. Conversion gain 25 dB.





TVCX-70 3x3.8"

Wired and tested xtal conv. boards:

TVCX-70 Specify 70cm input freq to ch3 or IF...$ 99
TVCX-33 Specify 33cm input freq to ch 3 or IF.$109
TVCX-23 Specify 23cm input freq to ch 8 or IF.$129
Ready to go in 1590C aluminum box add $30

Tuneable downconverters ready to go:

TVC-4G 420-450 MHz to ch 2, 3 or 4.....$89
TVC-9G 902-928 MHz to ch 2, 3 or 4.....$99
TVC-12G 1240-1300 MHz to ch 7 or 8.....$109

COMPLETE RECEIVERS

Two composite video outputs, one for local monitor, the other to plug into VCR or transmitter. 8 ohm speaker and 1 volt into 10K line audio outputs. Adjustable audio squelch. Req. 13.8 Vdc @ 300 mA.

ATVR-4 Specify 70cm input freq.....$299
ATVR-9 Specify 33cm input freq.....$309
ATVR-23 Specify 23cm input freq.....$319

3/89

ATV Q & A FEEDBACK

By Tom O'Hara, W6ORG

100 WATT 70 cm AMPS

Many of you tried the upgrade and power increase changes in your Mirage D1010N-ATV's from the last issue with good results.

One ham suggested putting a short coax jumper in place of the 22 ohm resistor instead of one longer one from the amp PC board input stripline. I don't see why not, but be careful soldering the braid at both ends to the board and the center conductor lead lengths. The extra coax does put 2 more small impedance bumps in the line.

What to do about other amps such as the older KLM, TE Systems, Tokyo Hi-power, and new RF Concepts 100 watt amps? I might have something for these people in the next issue.

I have tested the TE Systems and the RF Concepts. Both do not have the bias and B+ feed stiffness required to pass an AM video modulated signal without major distortion and roll off. I have been working on the RF Concepts and hope to have some design changes fed back to the company in time for Dayton. The TE Systems wanted to go into oscillation with any caps added on the bias and B+ lines. It is critical to have the right combinations of inductors and caps that keep a low source impedance up to 5 MHz but don't allow the two stages to go into a low frequency oscillation on frequencies a little higher.

I don't know about the Tokyo Hi-power 100 watt amp but would like to check one out. I need your feedback. The problem usually shows up as unstable sync, color shift or smearing especially with peak syncs over 50 watts.

WATT'S THAT YOU SAY?

There is still a lot of confusion as to *watt* I mean when I say the D1010 is a 100 watt amp, D24 a 50, etc., when we hear someone on the air saying he is getting something far less with his.

We all want a little more out of our amps than the next guy, but with an AM modulated complex waveform, it is difficult to compare Bird wattmeter readings with any real meaning unless all use the same standard. The FCC a few years ago changed the rules to give power limitations in peak envelope power so that each mode would not need a separately defined value.

The p.e.p. is easily measured with most all modes. With ATV it is the power read on a Bird wattmeter with no video plugged in and the blanking pedestal pot cranked to maximum power out. This CW power is the maximum peak power your system is capable of. It will occur on the sync tip no matter where your blanking pedestal is set, video gain level, or relative amount of black or white in the picture.

To get the proper video to sync ratio necessary for a stable picture at the other end, the blanking pedestal must be set, with no video plugged in, to 56% of the peak sync power. During modulation, even though it will not show on the Bird wattmeter, the sync tip and blanking power in a properly operating ATV transmitter will still be those same power levels you read.

Many ATVers erroneously give their power out as that read on a Bird wattmeter under video modulation as "average power". The standard Bird wattmeter with slugs that most of us have does not read true average power with a complex AM waveform having components over 50 KHz. So to compare one stations power to another this way is very inaccurate, not only from the power meter, but because of where each person set the blanking pedestal, depth of video modulation, and what is in the picture. A scene that is predominantly black will read higher than one mostly white.

MAX HEADROOM

Unfortunately, the gain of many of the amps year by year has gone up. What, you say? Don't we always want more? That's OK with CW and FM modes but with ATV you have to stay just within the amps linear region. When I first tested the D1010N the blanking pedestal on my TC-1 was running about 7 watts. Now it's down to 4. The TXA5 + PA5 basic modules back then peak sync was typically 11 to 12 watts. It matched the amp real close. Now with the Toshiba SAU4 brick we are getting 15 watts p.e.p. when driven by the TXA5-5 (all with 13.8 Vdc).

The result is that the peak sync input to the 100 watt amp drives it into complete saturation (110-120 watts). With no headroom, the superimposed sound subcarrier gets squashed on the sync tip, the top of the color burst is compressed, and reduces the dynamic range - affects grey scale, especially the white end. I suggest 12 dB as the minimum dynamic range for ATV systems.

For the black and white call plate DXer's it is probably no big deal, but for public service work, and those interested in video quality, you might consider setting your max drive sync tip power to 90% (only 1 dB) of the saturated amplifier power level.

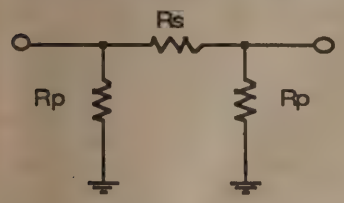
Loss from a long length of interconnecting coax can do that easily, but it's loss will also affect the receive if you don't have an antenna mounted preamp or one in the amp. Or you could put a coiled up length of small RG174 50 ohm coax (Belden 8216) in place of the coax between the amps first stage input and T/R relay as a 50 ohm attenuator with no affect on receive. At 70cm you get about 3 dB loss per 17 ft.

I prefer coax attenuators for powers between 1 and 15 watts over resistor networks at UHF because they are naturally 50 ohms, have virtually no VSWR except if the center conductor or braid leads are long, and have greater attenuation of harmonics.

Coax Attenuation /100 ft:

Belden	8216	9203
	RG-174	RG-58
70cm	18 dB	11.5 dB
33 cm	28.5 dB	20 dB
23cm	36 dB	26 dB

You can use a pi resistive network but the lead lengths become significant inductors as frequency goes up. The resistor must be non inductive types (no wirewounds) and their wattage rating should be twice that of the power dropped through them. Keep leads extremely short.



50 Ohm Resistor Pi attenuator network to closest 5% values:

	1 dB	3 dB	6 dB	10dB
Rp	820	300	150	91
Rs	5.6	18	36	68

POWER MODULES

I got a lot of questions about proper feeding of power modules from different transmitters. The 1 watt transmitters can blow out any of the 70cm bricks - Motorola MHW-710, MHW-720, Amprex BGY-41B, Toshiba SAU4, and the older RCA and TRW units. Max power input to these is 250 mW. They are made for 50-100 mW nominal drive.

Some with the 1 watt rigs found out the hard way thinking that if the pedestal pot could be cranked down far enough or the transmitter variable caps detuned, it would work without an attenuator. They forgot that the sync stretcher still pulls the sync up to around 1.5 watts, or that detuning the transmitter changes the frequency response, linearity, and could be come unstable. An attenuator at the brick's input is the proper way to go.

Others have also popped the first stage in the 50 watt D24's - max input 4 watts - by adjusting down their 10 watt transmitters in like manner without an attenuator. Mirage has changed the model number of the D24 to D26. It is the same amp with the ATV mods I gave them a few years back, but they finally ran out of printed labels and literature with D24 on it. The 4 stood for 40 watts. The mods also increased the max power to 60 watts.

On the other bands, I have tested the Motorola, NEC and Toshiba 900 MHz and the Toshiba 1200 MHz power modules. The 900 MHz "cellular" FM modules were disappointing. The dynamic range was only 6-8 dB (full on to full off output power with varying drive) since these, designed for the highly competitive cellular market, units did not have any internal bias on the first stage. Low drive levels usually require a small amount of bias on the transistor so that the RF waveform swings above the .7 Volt base - emitter turn on point.

Since the blanking is set to almost 3 dB down from peak sync, that left only 3 to 5 dB of range for the video. You would like at least 7 dB of range for good grey scale plus a few dB of headroom, or in this case bottom room for whites. White level is almost 10 dB down from peak sync in a proper system. While viewable pictures could be seen with this narrow modulation range, it took constant adjustment of video gain and pedestal as the modules warmed up and their RF gains changed or if the power supply voltage was changed a little.

The sound subcarrier had much more buzz due to no head room - sound subcarrier was cut off at sync tips and white limiting. A 10 dB attenuator was put on the modules input to drop the 1 watt output from the TXA5-33 to the required 100 mW. Max power into the modules is 400 mW before possible destruction.

Unlike their 70cm counterparts, I don't recommend the 33 cm power modules for AM ATV unless one is made for linear multimode rigs in the future.

The Toshiba M57762 23 cm module worked great. It is designed for multimode rigs, so it had great linearity and dynamic range. It started to compress at about 12 watts. Maximum input is 1 watt. For ATV using the TX23 1 watt transmitter, 4 dB's of RG 174 dropped the input power to the best linear range. With peak sync at 13 watts, I set the pedestal at 7.5 watts. This took .3 watts at the module input after the attenuator.

A good source of any of these power modules plus a wide stock of transistors for transmitting and receiving is RF Parts, 1320-16 Grand Ave, San Marcos CA 92069 (619-7440728). Get their catalog and see their ads in QST.

I have tested the Downeast Microwave 18 watt amps for 33 and 23 cm found that they are very linear and do a great job connected directly to the 1 watt transmitters. For more info contact Bill Olson at Box 2310 RR1, Troy ME 04987 (207-9483741). He also has some nice low noise preamps and long loop Yagi's for 33 and 23 cm.

FILTERS - VSB - REPEATERS

I have been getting about twice the calls about putting up a repeater this year compared to last. It varies between inband and crossband where it used to be exclusively inband.

Some repeaters using the TX-RX 70 cm inband duplexer to one good antenna report some desense and some did not. This is after going back and making sure everything was double shielded, etc. The problem seems to be the differences in intermod in the transmitters and amps.

The sideband harmonics and their intermods before filtering can be anywhere from 40 to 80 dB down 12 - 18 MHz away on the repeater receiver frequency. But 40 dB down from 50 - 100 watts is very significant when you figure the repeater receivers noise floor is 150 dB below the transmitters peak power output. If you take the 80 or more attenuation of the duplexer plus the worst case of 40 dB down sidebands, you still can have have as much as 30 dB above the noise interference.

Reducing the IM in the transmitter and amp can help, as well as putting in another VSB filter, such as the Spectrum International PSF-421-ATV, between the exciter and amp, or putting notch filters in the transmitters line. Attention should also be paid to proper linear drive levels, since the unwanted sideband harmonics and IM increase very quickly as you get into amplifier compression. The higher the amp power, the more important.

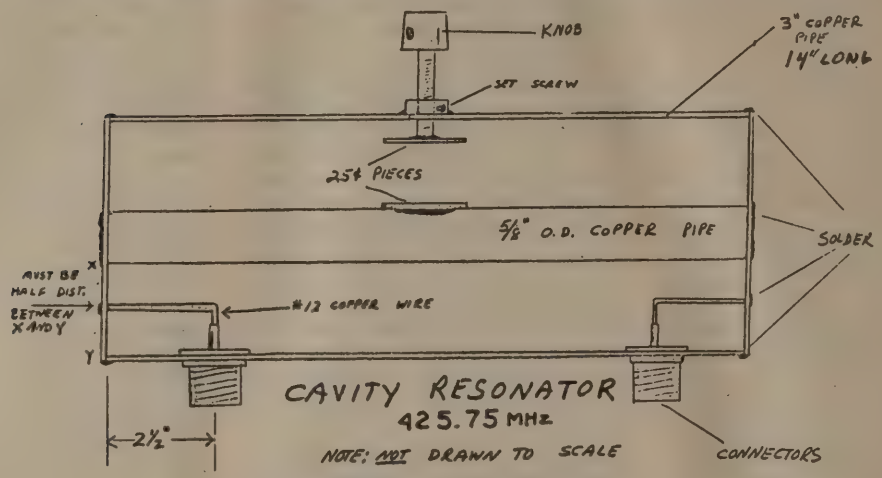
I did some experimenting with the KPA5 looking at reducing the IM and found that a little base bias of the MRF555 could cut it down 10-20 dB. I put a 680 ohm resistor from the MRF555 base to the +13.8. If you try it, make sure the base to ground resistor is 22 ohms, and connect the body of the 680 ohm resistor directly to the base with no more than 1/4"

lead. Sleeve the other lead and connect to a + 13.8 V trace next to the 2N3734 modulator collector. On older units using a MRF628 and / or a 47 ohm resistor to ground on the base, run a 1.5K resistor in like manner to +.

The advantage of running a duplexer rather than two antennas is not only the cost savings of one antenna and hardline, but also the receive and transmit point in space is the same. You can get higher isolation however with 2 antennas by finding the magic null point as previously discussed in the Q & A section.

TX-RX now has a 33 cm VSB filter available. Spectrum International just came out with the PSF-1253-ATV VSB filter for 23 cm. It has 2.8 dB insertion loss and goes for $182.

1/2 WAVE CAVITY BANDPASS FILTER BY KEN GUILLOT, WB5JLZ



SEPARATE SOUND XMTR

WB5JLZ's Baton Rouge ATV Repeater uses a separate FM sound transmitter at 425.75 MHz in order to make the sound come out better with weak signals. When subcarrier is mixed with the video you are limited to about -18 dBc depending on headroom, but you can go to -7 dBc with a separate transmitter and antenna for sound.

He had some problems getting enough deviation and proper pre-emphasis for which I marked up his schematic with changes to try. This worked fine on the bench but when connected to the antenna at the repeater site, it interfered with the receive video.

The FM transmitter strip he used starts with a 12 MHz crystal which is going to have some small amount of energy plus noise on multiples of the crystal. Also the final transistor will generate intermods with any other transmitters in the area which may fall in the receiver passband. I suggest that any repeater transmitter have a bandpass filter on it's output to prevent IM interference to it's neighbors.

To get rid of the problem he built his own bandpass filter using some 3" and 5/8" O.D. Copper tubing you can get at a hardware or plumbing supply store. This filter is similar to the half wave filter in the ARRL Handbook which uses a 10" Bud box but is 100% shielded. Ken, WB5JLZ, says that it is a half wave filter but half wave would be about 13.1" by my calculations instead of 14".

I suspect the tuning was broad enough that it passed enough of the signal at 425 even though it would have peaked lower. He told me he didn't take time to check the insertion loss closely or tuning range because he wanted to get the machine up on the air asap....and it worked.

I would like to hear back from someone that intends to try it with some test data on insertion loss and bandpass. I would experiment with a shorter length also to narrow the bandpass and move up the tuning range for the whole band.

I experimented with an Alinco ALR-72T 25 watt 70cm FM transceiver for use as a separate sound transmitter. The conversion to 25 KHz deviation and 75 us pre-emphasis was as easy as paralleling one resistor in the pre-emphasis network. All I did was put a 22K resistor in parallel with the 180K resistor R50. This resistor is connected to the wiper of the deviation pot VR2. The frequency range of the synthesizer can be changed by solder jumpers on the control board for 430-440 MHz. I have not had time to see if I can make it go down to 420.

FREQUENCY COORDINATION

Lots of calls on this one also. The time has come for FM repeater coordination councils to become area Spectrum Managers. While these councils have evolved out of the necessity to coordinate FM repeaters to prevent interference, there are now more and more other modes using the bands above 70cm that must also be fit in.

The volunteers who do this thankless job naturally came from the FM repeater group. Now we as ATVers are pounding on them for coordination and interference protection asking for big chunks of

the spectrum. You cannot expect them to be familiar with the characteristics and operating practices of ATV. So don't be surprised if you get a flat NO, go away, or why don't you go to a higher unused band.

Even the well intentioned or well known and respected in one mode cannot do a proper job of local band planning and spectrum management. I suggest your ATV community get together and get the best communicator and the best technically competent, and then these two people volunteer to become members of the spectrum management technical committee representing ATV.

The technical committee should also be made up of two people from all other modes - packet, satellites, weak signal as well as FM repeaters and control links. I think this is the only intelligent way to come up with a local workable bandplan that all can agree to. This has been working here in Southern California since 1972 when our technical committee was first formed. If it works in the highest communications density area in the USA it should work anywhere else.

Going by the crystal orders the past few years the shift does seem to now be from 439.25 to 434.0 due to increases in FM repeaters between 440 and 444 MHz. Although many order combinations of single and two freq transmitters, I used to use equal numbers of crystals among 426.25, 434.0 and 439.25. Now it is shifting to more 434 and less 439.

The big decision in your area must be made sooner than you think! You can stay on 439.25 for a long time if you can get your coordination council to fill up 444-445 MHz with FM repeaters first before going below 444 MHz. This gives 40 FM repeaters in any given area before full. But when that day comes, and push comes to shove, you may not have 434.0 to go to. It may be filled with packet or links from 433 to 435 MHz.

All the 220 people who will be displaced if the bottom 2 MHz is actually removed are looking to 70cm for a home. If a no code license goes through, one of the possibilities is 70 cm privileges. 70cm may fill in your area like two meters. In my area it filled 8 years ago.

No matter if you want to fight for 439.25 or 434.0, the time is now to let your coordination council know there are a lot of ATVers out there and growing. The packet and satellite people have a lot of appearance to coordination councils and the League because they are vocal and write articles. Get your activity known by volunteering to help your local coordination council get into spectrum management intelligently, and anytime you do a public service event with ATV, give a radio club talk, etc. as a minimum drop a note to your ARRL SCM so it gets printed in QST.

Get positive about your mode and promote it, stay away from the name calling and negative responses to others who probably just have the same zeal for their main interest in the hobby. Cooperation and help can go a long way. There is room for everyone in the 30 MHz of spectrum between 420 and 450 MHz.

REPEATER ANTENNAS

For horizontal polarization you will have to build your own. I know of no commercially made horizontal omnis which have proven out with decent gain that are not in the thousands of dollars. I suggest contacting the two best known amateurs who have been perfecting the Alford slot (Merle Reynolds, W9DNT, 710 25th Ave Ct. Moline IL 61265) and Rib Cage slot (Gerald Cromer, K4NHN, 1014 Summerland Dr., Cayce SC 29033) for their latest construction information and advise. Measured gains have been in the 4 to 7 dBd range on 70cm. I don't know if the bandwidth has ever been measured but the antenna should be scaled to favor the transmitter.

There are a number of commercially made vertical omni's made for FM communications that give 6 to 11 dBd gain. Another consideration is that repeaters sharing a commercial site may be required not to have a homemade antenna do to the owners fear a ham antenna might come down or cause damage under heavy ice or wind conditions. Most popular are the exposed multiple dipole types.

They cover 406 to 512 MHz and can be placed on a mast for a cardioid pattern or omni. The 4 bay types get 6 dBd omni or 9 dBd cardioid. Another bay can be added for up to 11 dBd. Sources are: DB Products (214-6310310), Sinclair (716-8743682), and Telewave (415-9684400). Celwave makes the fiberglass stick type (904-7879200).

CMC Distributing in Van Nuys CA (818-9944455) reps a number of these commercial and amateur antenna manufacturers and could help in your selection, ask for Bob WB6CLG.

There are some amateur stick and dipole types that are less rugged and less cost. Cushcraft (603-6277877) and Max-Rad (312-5953933) make the multiple dipole types, and NCG Co. (714-6304541) has the fiberglass transposed coax section "sticks".

NCG Co. also has quite an interesting variety of multiband UHF antennas and duplexers. Their gain claims are very exaggerated but still have good real gains over a dipole. They have 10 dBd sticks for 33 and 23 cm that most of us use on the ATV and FM repeater outputs here.

COLOR LOSS SOLUTION

Some repeaters and ATVers who put their system together with modules report color loss. This could be due to too many RF bypass caps on the video line. For 75 ohm terminations there should be no more than 220 pF total. If you used a 500 ohm or higher video gain pot with 100 ohm across it, make sure any bypass on the wiper is no more than 100 pF. I have ordered a stock of good quality 100 ohm panel pots.

HAM TV SIGN LANGUAGE
JOHN RUCKERT WB6ZPN

Sign language communications can be done on ham TV. Your quick inquiry or interest of possible future support is needed. The number one goal is to do live ATV sending demos for leading organizations helping the deaf community. Send a note with a long SASE to HAM TV SIGNERS, c/o John Ruckert WB6ZPN, 953 South Beacon Ave., Los Angeles, CA 90015. Note: John is a member of GLAD--Greater Los Angeles Council on Deafness.

BASIC PROGRAM TO FIGURE EXPECTED SIGNAL STRENGTH IN FREE SPACE

This is written in Microsoft Basic for the Radio Shack TRS-80 Model III but has remarks to enable adapting to any other computer. Given the measurable variables it will give the peak carrier to noise ratio as well as the distance to the RF horizon given a flat surface. It is a good starting point to figure repeater coverage area. The program also lets you change the variables one at a time. Any ham is free to use it in his computer except for profit, reprint, copy or sale. Tom O'Hara, EXAMPLE:

```
RF TRANSMISSION PATH LOSS.   BY TOM O'HARA, W6ORG.

FREQUENCY..................................  434  MHZ
DISTANCE...................................  22  MILES
TRANSMITTER POWER..........................  1.5  WATTS
TRANSMIT ANTENNA GAIN......................  14  DB
TRANSMIT COAX LINE LOSS....................  3  DB
FREE SPACE PATH LOSS.......................  116.2  DB
SIGNAL STRENGTH ARRIVING AT RECEIVE SITE.... -75.6 DBM 37.2 uV
RECEIVER ANTENNA GAIN......................  14  DB
RECEIVER COAX LOSS.........................  3  DB
SIGNAL STRENGTH AT RECEIVER INPUT..........  -66.7 DBM 103.1 uV
MINIMUM RECEIVER SENSITIVITY IS............  -106.2  DBM
   (SYSTEM NF= 3 DB WITH 3000 KHZ BW)          1.1  MICROVOLTS
CARRIER TO NOISE RATIO IN THIS CASE IS.....  39.5  DB.
TRANSMIT ANT HEIGTH 70 FT,  RF HORIZON IS....  11.8 MILES.
RECEIVE ANT HEIGTH 50 FT,   RF HORIZON IS....  10 MILES.
```

```
1 POKE 16427,75:REM TRS80 III, SETS PRINTER LINE WIDTH LIMIT.
2 REM CLS CLEARS SCREEN
3 REM TV VIDEO IF BANDWIDTH IS TYP 3 MHZ, SOUND IS 200 KHZ, AND NBFM IS 15 KH
Z.  SNOW FREE ATV PICTURE IS ABOUT 40 DB CARRIER TO NOISE RATIO.
10 CLS:PRINT"RF TRANSMISSION PATH LOSS & CARRIER TO NOISE RATIO.":PRINT"   BY
 TOM O'HARA  W6ORG  (C) 7/81"
100 PRINT:INPUT"ENTER FREQUENCY IN MHZ.............................";F
110 INPUT"ENTER DISTANCE IN MILES..........................";D
120 INPUT"ENTER TRANSMITTER OUTPUT POWER IN WATTS..........";X
130 INPUT"ENTER TRANSMITTER COAX LOSS IN DB................";L1
140 INPUT"ENTER TRANSMIT ANTENNA GAIN IN DB OVER A DIPOLE....";A1
142 INPUT"ENTER TRANSMIT ANTENNA HEIGTH ABOVE GROUND IN FT...";H1
150 INPUT"ENTER RECEIVE ANTENNA GAIN IN DB OVER A DIPOLE.....";A2
152 INPUT"ENTER RECEIVE ANTENNA HEIGTH ABOVE GROUND IN FT....";H2
160 INPUT"ENTER RECEIVE COAX LOSS IN DB....................";L2
170 INPUT"ENTER PREAMP TRANSISTOR NOISE FIGURE IN DB.......";N
180 INPUT"ENTER RECEIVER BANDWIDTH IN KHZ (TV IS 3000).....";B
190 PRINT
200 GOSUB 400
210 GOSUB 500
220 INPUT"ENTER C FOR CHANGES,N FOR ALL NEW, OR P FOR PRINTOUT";C$
230 IF C$="C" GOSUB 700
240 IF C$="P" GOSUB 900
250 IF C$="N" GOTO 10 ELSE 220
400 L=36.6+20*(LOG(F)/LOG(10))+20*(LOG(D)/LOG(10)):REM PATH LOSS
410 W=30+10*(LOG(X)/LOG(10)):REM XMTR POWER TO DBM
420 R1=W+A1-2.15-L1-L:REM DBM AT REC SITE
430 M1=10[(.05*(107+R1)):REM DBM TO MICROVOLTS
440 R2=R1+A2-2.15-L2:REM ADD ANT GAIN LESS COAX LOSS
450 M2=10[(.05*(107+R2)):REM DBM TO MICROVOLTS, [ IS EXPONENT
460 S=-174+10*(LOG(B*1000)/LOG(10))+N+1:REM -DBM MIN SENSITIVITY
470 S1=10[(.05*(107+S)):REM -DBM TO MICROVOLTS
480 S2=R2-S
490 H3=1.415*SQR(H1):H4=1.415*SQR(H2):REM RF HORIZON
499 RETURN
500 CLS
```

```
510 PRINT"FREQUENCY..................................... ";F;" MHZ"
520 PRINT"DISTANCE...................................... ";D;" MILES"
530 PRINT"TRANSMITTER POWER............................. ";X;" WATTS"
540 PRINT"TRANSMIT ANTENNA GAIN......................... ";A1;" DB"
550 PRINT"TRANSMIT COAX LINE LOSS....................... ";L1;" DB"
560 PRINT"FREE SPACE PATH LOSS.......................... ";INT(L*10+.5)/10;" DB
"
570 PRINT"SIGNAL STRENGTH ARRIVING AT RECEIVE SITE.... ";INT(R1*10+.5)/10;"DB
M";INT(M1*10+.5)/10;"uV"
600 PRINT"RECEIVER ANTENNA GAIN......................... ";A2;" DB"
610 PRINT"RECEIVER COAX LOSS............................ ";L2;" DB"
620 PRINT"SIGNAL STRENGTH AT RECEIVER INPUT............ ";INT(R2*10+.5)/10;"DB
M";INT(M2*10+.5)/10;"uV"
640 PRINT"MINIMUM RECEIVER SENSITIVITY IS.............. ";INT(S*10+.5)/10;" DB
M
650 PRINT"   (SYSTEM NF=";N+1;"DB WITH";B;"KHZ BW)";TAB(45)INT(S1*10+.5)/10;"
 MICROVOLTS":REM 1 DB ADDED TO TOTAL SYSTEM NOISE FIGURE TO ACCOUNT FOR 2ND S
TAGE NF.
660 PRINT"CARRIER TO NOISE RATIO IN THIS CASE IS.......";INT(S2*10+.5)/10;" D
B."
670 PRINT"TRANSMIT ANT HEIGTH";H1;"FT,"TAB(28)"RF HORIZON IS....";INT(H3*10+.
5)/10;"MILES."
680 PRINT"RECEIVE ANT HEIGTH";H2;"FT,"TAB(28)"RF HORIZON IS....";INT(H4*10+.5
)/10;"MILES."
690 RETURN
700 CLS:PRINT"SELECT CHANGE:":PRINT:PRINT"1.  FREQUENCY.":PRINT"2.  DISTANCE.
":PRINT"3.  TRANSMITTER POWER."
710 PRINT"4.  TRANSMITTER COAX LOSS.":PRINT"5.  TRANSMIT ANTENNA GAIN.":PRINT
"6.  RECEIVE ANTENNA GAIN."
720 PRINT"7.  RECEIVE COAX LOSS.":PRINT"8.  PREAMP TRANSISTOR NOISE FIGURE.":
PRINT"9.  RECEIVER BANDWIDTH IN KHZ."
725 PRINT"10. TRANSMIT ANTENNA HEIGTH":PRINT"11. RECEIVE ANTENNA HEIGHT."
730 INPUT C:INPUT"ENTER NEW VALUE...";V
740 IF C=1 THEN F=V:GOTO 200
741 IF C=2 THEN D=V:GOTO 200
742 IF C=3 THEN X=V:GOTO 200
743 IF C=4 THEN L1=V:GOTO 200
744 IF C=5 THEN A1=V:GOTO 200
745 IF C=6 THEN A2=V:GOTO 200
746 IF C=7 THEN L2=V:GOTO 200
747 IF C=8 THEN N=V:GOTO 200
748 IF C=9 THEN B=V:GOTO 200
749 IF C=10 THEN H1=V:GOTO 200
750 IF C=11 THEN H2=V:GOTO 200 ELSE 700
900 CMD"Z":REM THIS COMMAND ON TRS80 III SENDS ALL SCREEN PRINTING ALSO TO PR
INTER.  IT IS A TOGGLE COMMAND, YOU MAY HAVE TO USE LPRINT INSTEAD WITH ANOTH
ER COMPUTER OR PROPER COMMAND.
910 CLS:PRINT:PRINT"RF TRANSMISSION PATH LOSS.   BY TOM O'HARA, W6ORG.":PRINT
:GOSUB 500
920 PRINT:PRINT:CMD"Z":REM TOGGLES SCREEN TO PRINTER OFF.
990 RETURN
```

ATVQ AT THE HAMFESTS

We would like to thank the folks who stopped by our booth at the Davenport, Iowa hamfest. We quickly sold out of copies of ATVQ we brought and gathered in more than 20 new subscribers. While there we were invited to do the ATV talk and have a booth at Peoria, IL, Des Moines, Iowa, and Cedar Rapids, Iowa hamfests, which we expect to be able to do. We also were invited to the Galesburg, IL ham club meeting to give a talk on ATV there. The date has not been set at this time but will be in the near future.

On March 3, Henry gave a talk at the Tri-town Radio club on ATV. The club has the distinction of giving a demonstration of LIVE ATV at the Chicago Worlds Fair in 1933!!! KA9TAP hosted the address by Henry which included part of the Rose Parade video tape. The talk covered public service, DX and local operations on ATV, basic how, to, how much, where to get info. The "show and tell" generated quite a lot of interest especially with the news of the ACLR ATV RPT.

KS8J ATV REPEATER CONTROLER

By Earl Campbell KS8J
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Publication Editor - Tommy Campbell N7KBO

This repeater controller project was inspired by the need for a programmable control circuit. The 8052 AH Basic micro-controller IC turned out to be ideally suited for this project. This chip has an 8K control basic language as well as I/O built right into the chip. Since you can program this controller using the basic language, implementing different operating needs and conditions are a snap.

I have broken the circuit down into 3 major areas as follows:

1. CPU and optional RS-232 interface
2. Memory and I/O
3. Video and audio control.

The circuit may be constructed using standard wire wrap or point to point construction techniques or a circuit board may be fabricated.

Figure 1 shows a MAX 233 RS-232 interface while Figure 1A shows a MAX 232 RS-232 interface as well as Figure 1B that shows the discrete component RS-232 interface. All 3 circuits utilize a single +5 VDC supply voltage to develop the + - 12VDC RS-232 voltages. The only difference being component availability, complexity and cost.

Figure 2 shows the layout for the 32K RAM and 8K EEPROM wiring. I chose 32K of RAM for development work although only 2K of RAM is needed. You may change the RAM/EEPROM/EPROM to any size convenient, (greater than 2K). The INTEL 8052 Basic Manual gives many suggestions and circuit alterations. The 8255 PPI chip is used for I/O to the audio, video, VOR, relay keying circuits.

Figure 3 is the audio video relay keying circuit diagram. Note the touch tone decoder +5 VDC supply pin must be well by-passed for proper operation.

Figure 3A shows a similar interface using the much less expensive 4066 IC's instead of the MAX 455 multiplexer at a cost of a much more complex circuit and additional parts consisting of 2 74138s and 4 4066 IC's. The relay driver transistor may be any low voltage NPN switching transistor with a diode across the relay coil to prevent back EMF from destroying the transistor. The relay is a low current 5 VDC type from Radio Shack. The N/O contacts may be used to key a larger relay that in turn switches on the transmitter and amplifier. PPI outputs C0 and C1 may be used to select 1 of 4 video screens of the WB8ELK video ID unit (see last issue).

THEORY OF OPERATION

The controller is a stand alone computer system not requiring the RS-232 interface for normal operation. When power is applied, the system executes the pre-programmed basic program in EPROM. This program detects input from the touch tone decoder and the VOR inputs. If only one VOR input is used, the unused input should be grounded.

As you can see there are 8 video and 8 audio inputs to the multiplexer. Two of the audio inputs are used via the basic program for CW ID and to feed the TT audio to the ATV repeater audio channel. At the KS8J Repeater, we use 1 audio video pair for the 910 MHZ input, 1 pair for the 434 MHZ input, 1 pair for the local camera, and 1 video input for the Radio Shack color computer bulletin board video.

By touch tone control, we can route the touch tone audio to the ATV transmitter audio. Many possible combinations of touch tone control are available via programming. By reading the basic program listing, you can see that all the necessary repeater ID timing and control is accomplished via software timing as the 8052 chip has a timer built in!

This project has been fun as well as educational and could be adapted for control of all your audio video and keying needs in the shack. With the advent of computer interfaces on most modern HAM rigs, total control of the shack is possible limited only by your imagination. I have used this basic circuit for controlling my Yaesu 767 rig remotely via 2 meters. If you come up with any unique and useful applications, please drop me a note. I hope that this project is as much fun for you as it was for me.

I am at the present time working on a new project that will be a repeater controller with a software programmable video ID unit with live video and graphics overlays using an INTEL 82786 video chip.

I would like to thank Bill Brown WB8ELK for the encouragement he gave me to write this article and my wife Tommy N7KBO for her patience while I was working on the project and for her editing help. If anyone has any questions or comments, please feel free to contact me.

PARTS LIST

SUPPLIER	NUMBER	PART
R	2	IC's 78L05 or 7805 3 terminal voltage regulators
J	1	8052AH Basic CPU ($24.95)
J	1	2865A or 2764 EEPROM/ EPROM
J	1	42256 32K RAM
J	1	8255 PPI chip
M	1	MAX 233 or MAX 232
M	2	MAX 455 Multiplexer
R	1	SSI 202 R/S 276-1303 T/T Decoder
J	1	74373
J	1	7408
J	1	74138
J	1	11.0592MHZ crystal (see notes)
R	1	3.58MHZ crystal
R	1	5VDC relay R/S 275-240
J	1	10K OHM SIP resistor PAC (see notes)
	7	LED's
	1	1 MEG 1/4 W resistor
	7	470 OHM 1/4 W resistors
	12	.1 MFD capacitors
	1	10 MFD electrolytic capacitor

1	10K 1/4 W resistor
2	1N914 diodes
1	2N2222 NPN transistor
2	20 PF capacitors

OPTIONAL PARTS for MAX 232 Interface

5	10 MFD 15 VDC capacitors

OPTIONAL PARTS for Discrete RS232 Interface

1	1.8K resistor
4	4.7K resistor
1	NPN transistor
1	PNP transistor
2	1N914 diodes
1	10 MFD 15 VDC capacitor

NOTES:

1. Instead of the 10K OHM SIP you may use 8 10K 1/4W resistors stood up on end with all the top leads connected together and tied to 5 VDC or if you are bread boarding the circuit, you may choose to use a 10K resistor DIP.
2. The 78L05/7805 3 terminals voltage regulator is used to convert the normal 12 VDC out of the video operated relay circuit (horizontal sweep detector) to a +5 VDC level for the PPI chip.
3. The 11.0592MHZ crystal may be any value between 9 to 11.5MHZ. If you use a crystal other than the 11.0592MHZ specified, add a line in the program near the beginning that reads:
1 xtal=11059200
Substitute your crystal value in HZ for the 11059200 number.
4. The 8052 Basic Manual may be obtained from Intel, Publication Number 270010-003.
5. The RS-232 computer or terminal interface is optional and only needed if you wish to change, develop or otherwise modify the program.
6. The printed circuit board layout is for an RS-232 less stand alone operation with MAX 455 multiplexer 32K RAM and an EEPROM 8K or EPROM 8K with provisions for 2 VOR inputs. If anyone makes a printed circuit board for this project, let our readers know about the availability as I bread boarded this project.
7. If you send me a blank 2764 or 2865A, your crystal frequency, desired CW ID call letters; I will program the EPROM/EEPROM.

ADDRESSES OF SUPPLIERS:

J= Jamco Electronics
1355 Shoreway Rd
Belmont, CA 94002
(415) 592 8097

M= MAXIM Integrated Products Inc,
510 N Pastoria Ave.
Sunnyvale, CA 94086
(408) 737 7600

R= Radio Shack

Intel Corp.
3065 Bowers Ave.
Santa Clara, CA 95051

PROGRAM

```
1     REM
2     AUXA=3
3     AUXV=16
4     TMA=2
5     KU=0
6     IDV=0
7     FFV=8
8     IDA=0
9     FFA=1
10    TIME=0
20    XBY(0E003H)=91H
30    CLOCK 1
40    DDLY=3
50    IDT=3
55    MTD=600
60    FOR X=1 TO 24
70    PRINT
80    NEXT X
85    XBY(0E001H)=0
90    PRINT "Drop out
      delay ",DDLY
95    PRINT "ID Time
      ",IDT
100   TIME=0 :  GOSUB
      1000
105   PRINT "RKU =
      ,RKU," DV = ",DV,"
      TTD = ",TTD," Key
      Up's = ",KU, CR ;
106   IF DV=16.AND.TTD=11
      THEN IDT=30
110   IF DV=16.AND.TTD=11
      THEN  GOTO 4000
120   IF RKU=128 THEN
      GOTO 3000
130   IF DV=16.AND.TTD=15
      THEN  GOTO 500
199   GOTO 100
500   IDKU=TIME
510
XBY(0E001H)=128.OR.IDV.OR
.IDA
520 GOSUB 6000
530
XBY(0E001H)=128.OR.AUXV.O
R.TMA
540   IF TIME>IDKU+600
      THEN  GOTO 580
550   GOSUB 1000
560   IF DV=16.AND.TTD=12
      THEN  GOTO 3050
565   IF DV=16.AND.TTD=13
      THEN
XBY(0E001H)=128.OR.AUXV.O
R.TMA
566   IF DV=16.AND.TTD=15
      THEN
XBY(0E001H)=128.OR.AUXV.O
R.AUXA
570   GOTO 540
580
XBY(0E001H)=128.OR.IDV.OR
.IDA
590   GOTO 4099
1000  D=XBY(0E000H)
1010  RKU=D.AND.128
1020  DV=D.AND.16
1030  TTD=D.AND.15
1040  RETURN
3000  KU=KU+1
3005  PRINT
3010
XBY(0E001H)=128.OR.IDV.OR
.IDA
3015  GOSUB 6000
3020  IDKU=TIME
3030  IF TIME<IDKU+IDT
THEN  GOTO 3030
3035  ATV=FFA
3040  GOSUB 1000
3045  IF DV=16.AND.TTD=13
      THEN ATV=TMA
3046  IF DV=16.AND.TTD=14
      THEN ATV=FFA
3047
DV=XBY(0E000H).AND.16
3048  IF DV=16 THEN  GOTO
      3047
3049  IF TTD=11
      THEN GOTO 4000
3050  IF RKU=0 THEN  GOTO
      3300
3055  IF TTD=15 THEN
      GOTO 530
3060
XBY(0E001H)=128.OR.FFV.OR
.ATV
3065  IF TIME>IDKU+MTD
      THEN  GOTO 3500
3066  PRINT "Time to time
      out",(IDKU+MTD)-TIME,
      CR ,
```

```
3080  GOTO 3040
3300  DDY=TIME
3310  IF TIME>DDY+DDLY
      THEN  GOTO 3500
3320  GOSUB 1000
3330  IF RKU=0 THEN  GOTO
      3310
3340  GOTO 3040
3500
XBY(0E001H)=128.OR.IDV.OR
.IDA
3510  IDKU=TIME
3511  IDT=1
3520  IF TIME<IDKU+IDT
      THEN  GOTO 3520
3530  IDT=3
3999  GOTO 4099
4000  IDKU=TIME
4010  GOSUB 1000
4015  IF TTD=11 THEN
      GOTO 4000
4020  IF
DV=0.AND.TIME>IDKU+3
      THEN  GOTO 4099
4030  IF DV=0 THEN GOTO
4010
4040  PRINT  : KU=KU+1
4050  IDT=TTD*60
4060
XBY(0E001H)=128.OR.IDV.OR
.IDA
4065  GOSUB 6000
4070  GOSUB 1000
4080  IF DV=16.AND.TTD=12
      THEN
XBY(0E001H)=128.OR.IDV.OR
.IDA :  GOTO 4099
4082  IF DV=16.AND.TTD=13
      THEN
XBY(0E001H)=128.OR.IDV.OR
.TMA
4083  IF DV=16.AND.TTD=14
      THEN
XBY(0E001H)=128.OR.IDV.OR
.IDA
4085  PRINT
IDKU+IDT-TIME, CR , 4086
PWM 400,400,200 :
PWM 600,600,200
4087  OT=TIME
4088  GOSUB 1000 :
      IF DV=16
      THEN GOTO 4080
4089  IF TIME<OT+2
      THEN  GOTO 4088
4090  IF TIME<IDKU+IDT
THEN  GOTO 4070
4099  GOTO 560
5000  IDT=3
5010  FOR T=1 TO 1000 :
      NEXT T
5020  XBY(0E001H)=0
5030  FOR T=1 TO 1000 :
      NEXT T
5040  GOTO 60
6000  GOSUB 7000 :  GOSUB
      8000 : GOSUB 8000
6001  GOSUB 9000
6002  GOSUB 8000
6003  GOSUB 9000
6004  GOSUB 9000 :  GOSUB
      9000
6005  GOSUB 7000 :  GOSUB
      8000 :  GOSUB 7000
6010  GOSUB 9000
6020  GOSUB 8000 :  GOSUB
      8000 :  GOSUB 8000
6030  GOSUB 9000
6040  GOSUB 7000 :  GOSUB
      7000 :  GOSUB 7000
      :  GOSUB 8000 :
      GOSUB 8000
6050  GOSUB 9000
6060  GOSUB 8000 :  GOSUB
      7000 :  GOSUB 7000
      :  GOSUB 7000
6070  GOSUB 9000
6080  GOSUB 7000 :
      GOSUB 7000
6082  GOSUB 8000 :
      GOSUB 8000
6084  GOSUB 7000 :
      GOSUB 7000
6090  GOSUB 9000
6100  GOSUB 8000 :
      GOSUB 7000 :
      GOSUB 8000
6110  RETURN
7000  PWM 300,300,200
7010  FOR T=1 TO 40
7020  NEXT T
7030  RETURN
8000  PWM 300,300,100
8010  FOR T=1 TO 40
8020  NEXT T
8030  RETURN
9000  FOR T=1 TO 100
9010  NEXT T
9020  RETURN
READY
```

SNEAK PREVIEW OF THE AEA 430 FSTV TRANSCEIVER

Ron Hranac N0IVN

Western Vision Network had the opportunity to evaluate a prototype of the new AEA FSTV transceiver in February. The rig is a 70 cm vestigial sideband transceiver with 1 watt output and features a GasFET front end in the receiver. The prototype differed somewhat from the unit in AEA's advertisements due mainly to a new front panel layout and added features since those original photographs were taken.

The production unit will be nearly identical to the prototype we tested. The transmitter includes a class A output power amplifier stage, SAW filtering, one crystal is included with two frequencies an option. The camera video appears at the TV output jack on chanel 3 or 4 in transmit. The TV output from the downconverter goes through a selectable channel 3 or 4 SAW filter also.

If the prototype is any indication of the quality of production units, AEA will have a real winner here. Overall receiver noise figure measured 2.6 to 3.1 db depending on the frequency tuned to, using a Hewlett Packard 8970B noise figure meter. Power consumption at 13.8 VDC was .41 amps on receive and 1.03 amps on transmit. With a camera attached to the front panel connector (10 pin) the transmit power was 1.25 amps.

Transmitter power output was +28 dbm (0.631 watt) on sync tips with 1 volt p-p video input and 62% visual depth of modulation. At this output level, the sound carrier was 19 db below the video carrier and -33 db on the lower sideband. Transmitter video frequency response was +- 1 db to 4.5 Mhz. The downconverter conversion gain averaged 6 to 7 db across the band.

We exhibited the FSTV 430 at a local swapfest and comments about its appearance were very positive. During Western Vision Network's weekly net, the AEA transceiver was used to simulcast NET activity and on-air picture and sound quality was reported quite good.

A complete evaluation of a production model will be in the next issue of ATVQ along with a comparison to other production ATV transceivers on the market. By the time you read this the AEA FSTV 430 will be available at local AEA dealers.

About the author, Ron is an avid ATV'er and also is technical editor and contributor to several CATV industry publications and is a professional engineer specializing in CATV RF and video equipment.

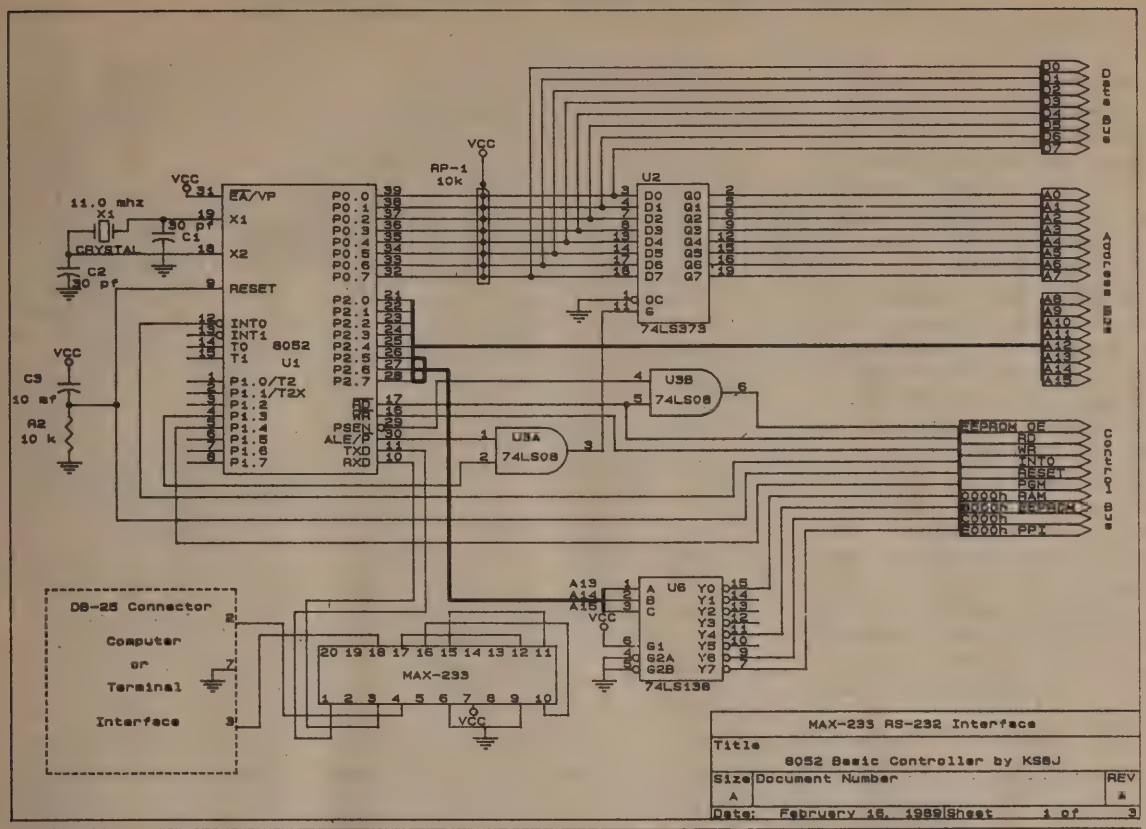

VCC
RP-1
10k
U2
74LS373
11.0 mhz
X1
CRYSTAL
30 pf
C1
C2
30 pf
RESET
EA/VP
X1
X2
INT0
INT1
T0
T1
8052
U1
P1.0/T2
P1.1/T2X
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
P2.0
P2.1
P2.2
P2.3
P2.4
P2.5
P2.6
P2.7
PSEN
ALE/P
TXD
RXD
C3
10 mf
R2
10 k
U3B
74LS08
U3A
74LS08
U6
74LS138
A19
A14
A15
G1
G2A
G2B
Y0
Y1
Y2
Y3
Y4
Y5
Y6
Y7
Data Bus
Address Bus
Control Bus
EEPROM OE
RD
WR
INT0
RESET
PSEN
0000h RAM
8000h EEPROM
C000h
E000h PPI
DB-25 Connector
Computer
or
Terminal
Interface
MAX-233
20 19 18 17 16 15 14 13 12 11
1 2 3 4 5 6 7 8 9 10
MAX-233 RS-232 Interface
Title
8052 Basic Controller by KS8J
Size
A
Document Number
REV
A
Date: February 16, 1989
Sheet 1 of 3

FIG. 1

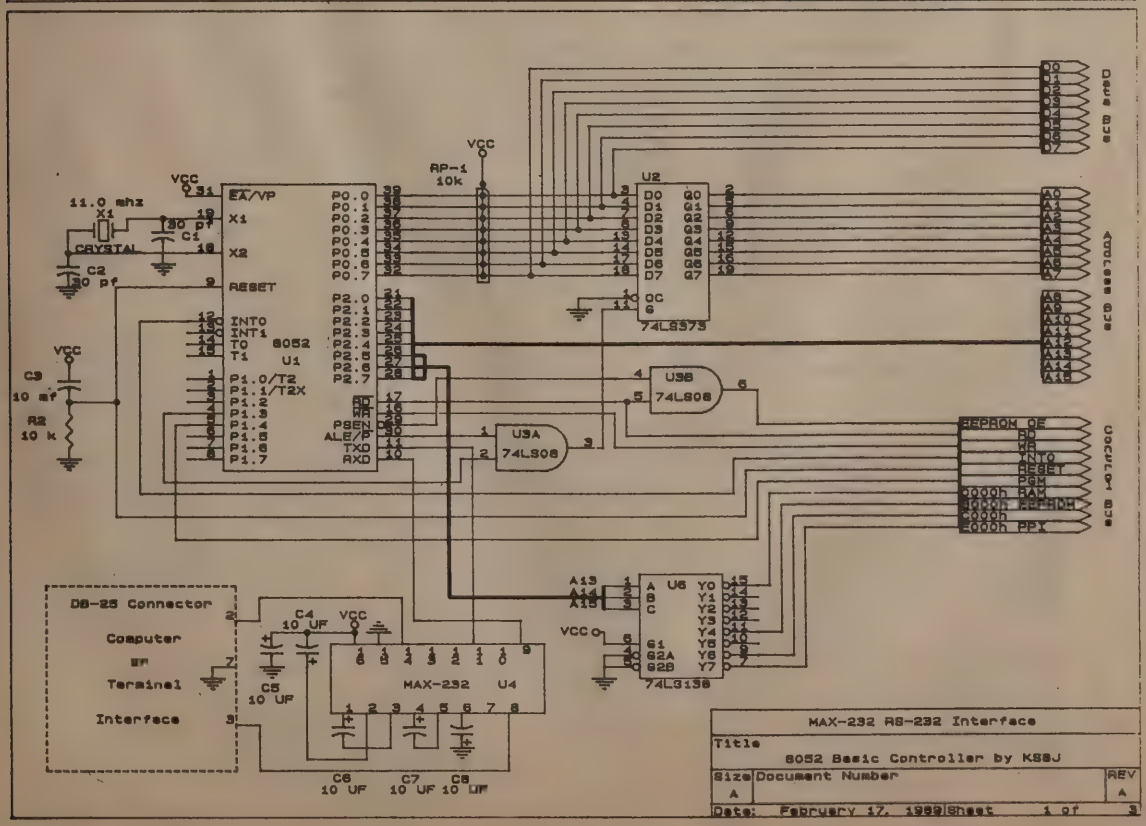

VCC
RP-1
10k
U2
74LS373
11.0 mhz
X1
CRYSTAL
30 pf
C1
C2
30 pf
RESET
EA/VP
X1
X2
INT0
INT1
T0
T1
8052
U1
P1.0/T2
P1.1/T2X
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
P2.0
P2.1
P2.2
P2.3
P2.4
P2.5
P2.6
P2.7
PSEN
ALE/P
TXD
RXD
C3
10 mf
R2
10 k
U3B
74LS08
U3A
74LS08
U6
74LS138
A13
A14
A15
G1
G2A
G2B
Y0
Y1
Y2
Y3
Y4
Y5
Y6
Y7
Data Bus
Address Bus
Control Bus
EEPROM OE
RD
WR
INT0
RESET
PSEN
0000h RAM
8000h EEPROM
C000h
E000h PPI
DB-25 Connector
Computer
or
Terminal
Interface
C4
10 UF
C5
10 UF
C6
10 UF
C7
10 UF
C8
10 UF
MAX-232
U4
1 2 3 4 5 6 7 8
MAX-232 RS-232 Interface
Title
8052 Basic Controller by KS8J
Size
A
Document Number
REV
A
Date: February 17, 1989
Sheet 1 of 3

FIG. 1A

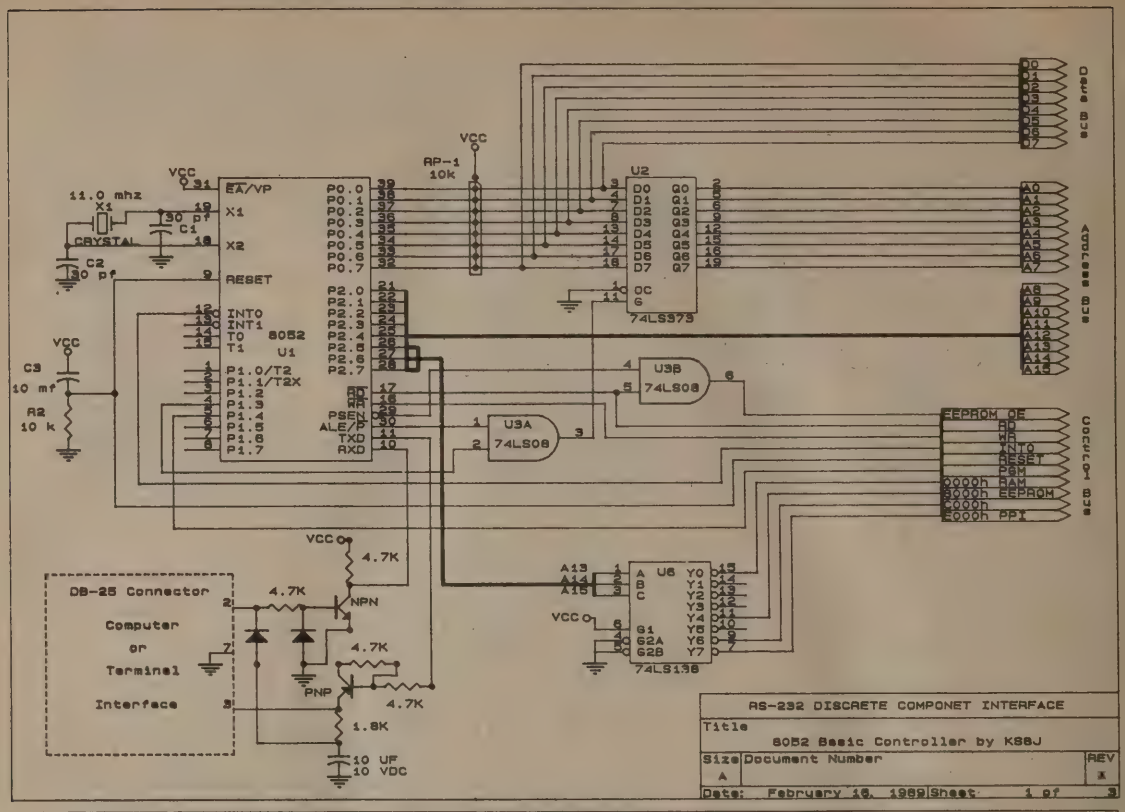

11.0 mhz
X1
CRYSTAL
30 pf
C1
C2
30 pf
VCC
EA/VP
X1
X2
RESET
INT0
INT1
T0
T1
8052
U1
P1.0/T2
P1.1/T2X
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
P0.0
P0.1
P0.2
P0.3
P0.4
P0.5
P0.6
P0.7
P2.0
P2.1
P2.2
P2.3
P2.4
P2.5
P2.6
P2.7
PSEN
ALE/P
TXD
RXD
C3
10 mf
R2
10 k
RP-1
10k
U2
D0
D1
D2
D3
D4
D5
D6
D7
Q0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
OC
G
74LS373
Data Bus
Address Bus
U3B
74LS08
U3A
74LS08
EEPROM OE
RD
WR
INT0
RESET
PSEN
0000h RAM
8000h EEPROM
C000h
E000h PPI
Control Bus
4.7K
DB-25 Connector
Computer
or
Terminal
Interface
NPN
PNP
1.8K
10 UF
10 VDC
A13
A14
A15
U6
Y0
Y1
Y2
Y3
Y4
Y5
Y6
Y7
G1
G2A
G2B
74LS138
RS-232 DISCRETE COMPONET INTERFACE
Title
8052 Basic Controller by KS8J
Size
A
Document Number
REV
Date: February 16, 1989 Sheet 1 of 3

FIG. 1B

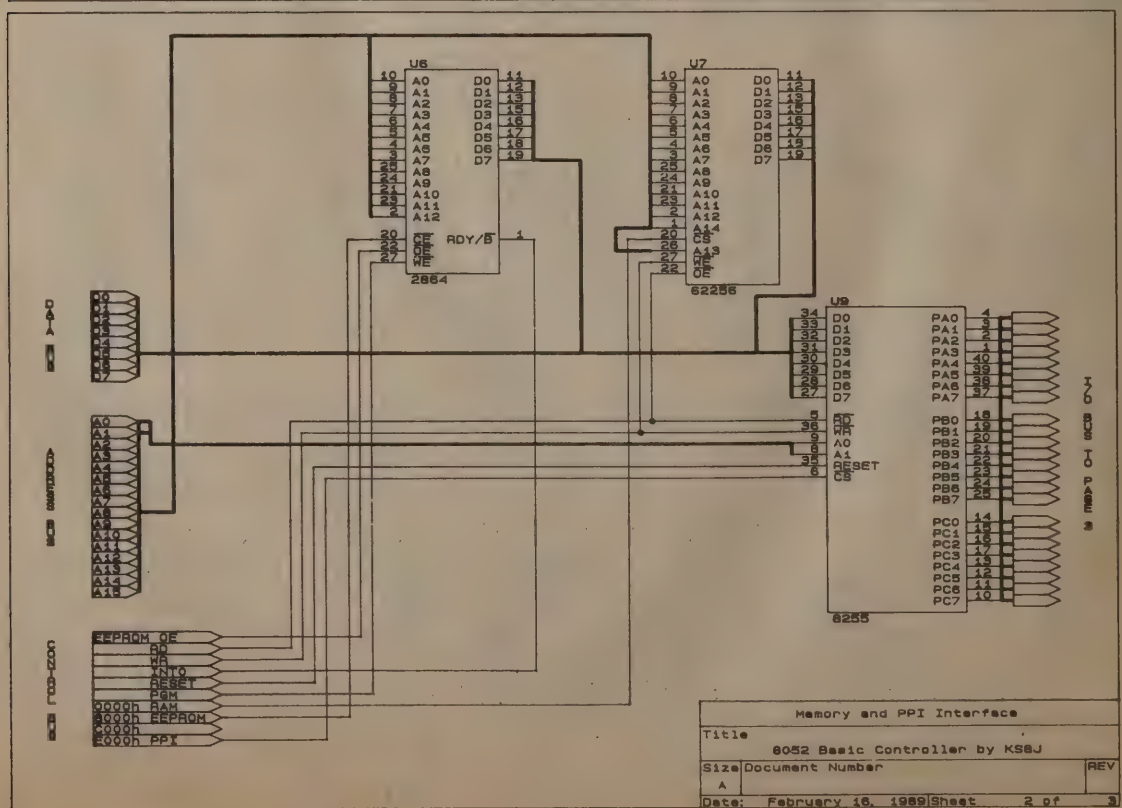

U6
2864
RDY/B
U7
62256
U9
8255
PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PB0
PB1
PB2
PB3
PB4
PB5
PB6
PB7
PC0
PC1
PC2
PC3
PC4
PC5
PC6
PC7
RESET
CS
I/O BUS TO PAGE 3
DATA
ADDRESS
CONTROL
EEPROM OE
RD
WR
INT0
RESET
PSEN
0000h RAM
8000h EEPROM
C000h
E000h PPI
Memory and PPI Interface
Title
8052 Basic Controller by KS8J
Size
A
Document Number
REV
Date: February 16, 1989 Sheet 2 of 3

FIG. 2

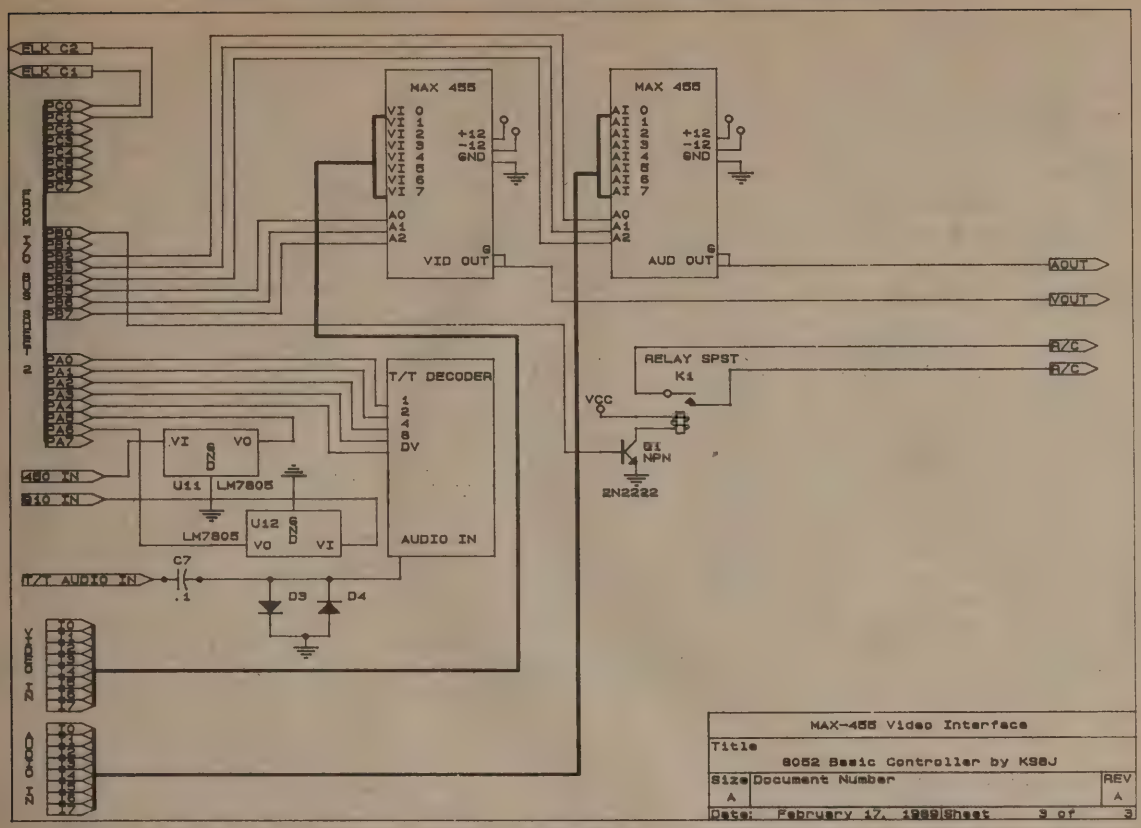

CLK C2
CLK C1
MAX 455
VID OUT
AUD OUT
+12
-12
GND
AOUT
VOUT
RELAY SPST
K1
VCC
Q1
NPN
2N2222
T/T DECODER
AUDIO IN
U11 LM7805
U12
LM7805
C7
.1
D3
D4
T/T AUDIO XN
MAX-455 Video Interface
Title
8052 Basic Controller by KS8J
Size
A
Document Number
REV
A
Date: February 17, 1989 Sheet 3 of 3

FIG. 3

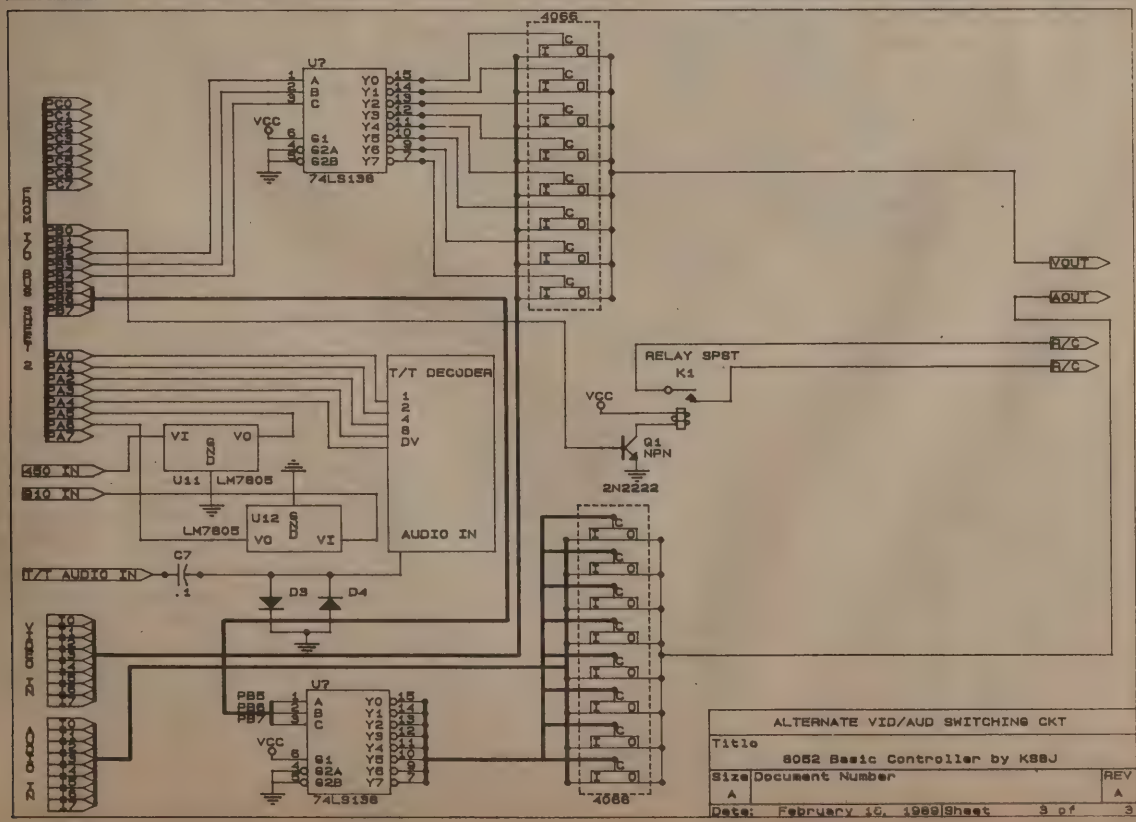
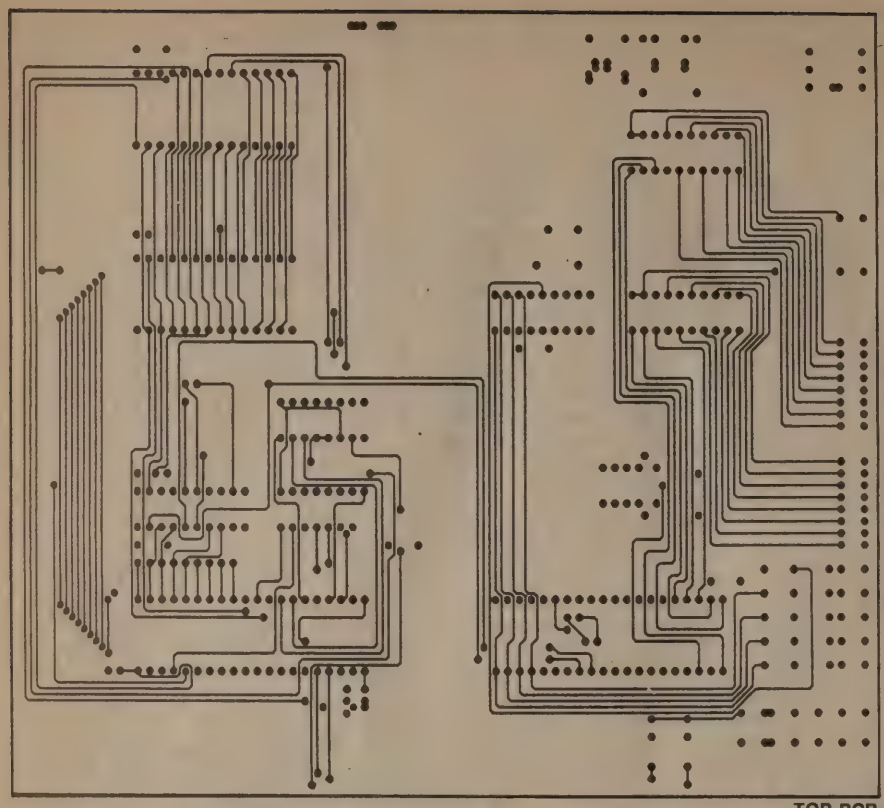
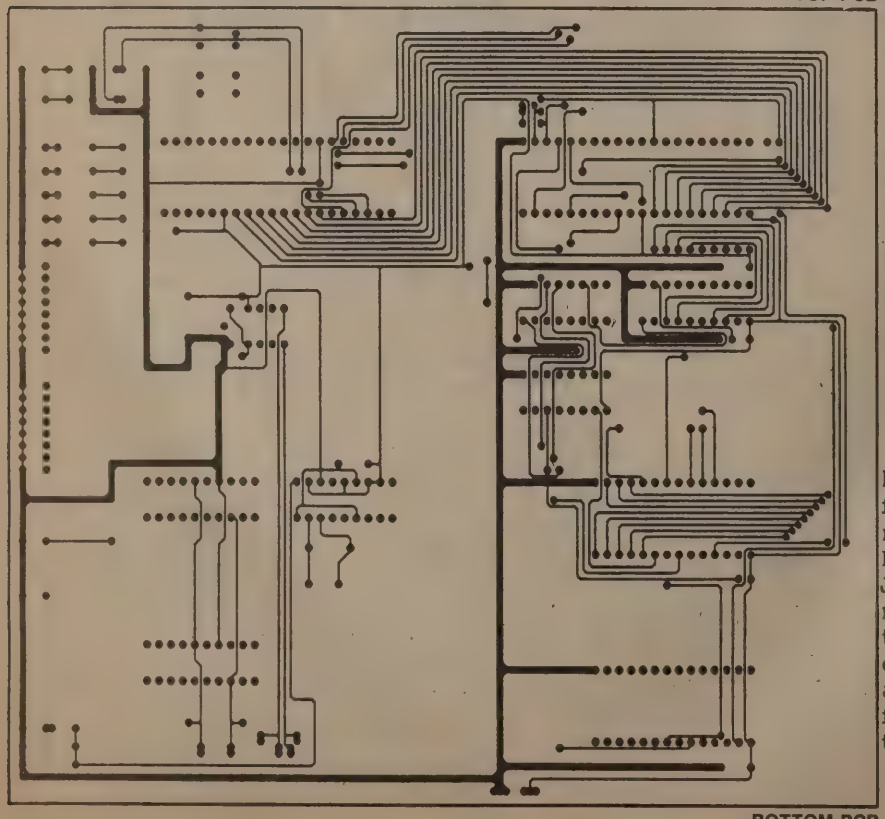

4066
U7
74LS138
VOUT
AOUT
RELAY SPST
K1
VCC
Q1
NPN
2N2222
T/T DECODER
AUDIO IN
U11 LM7805
U12
LM7805
C7
.1
D3
D4
T/T AUDIO IN
ALTERNATE VID/AUD SWITCHING CKT
Title
8052 Basic Controller by KS8J
Size
A
Document Number
REV
A
Date: February 10, 1989 Sheet 3 of 3

FIG. 3A



TOP PCB



BOTTOM PCB

ATVQ AT THE HAMFESTS

Is Indianapolis the next "Dayton"?

ATVQ attended the Indianapolis hamfest March 12th and the crowd was bigger than ever. Both commercial and flea market (both INDOORS) were sold out well in advance. The crowd was huge all day and didn't start to thin out until 2 PM. Contingents of ATVers were present from 5 states with groups from central Illinois, Bloomington, IN and Dayton/Cincinnati well represented. Our thanks to Bob W9PRD and Paul W9DUU who found us a table to share as we were too late in getting our request in for our own table. Our thanks to Larry WB8YAJ and Dave N9EFC who shared their table with ATVQ and who locals can contact for ATVQ subscriptions. Both work in broadcast TV in Indianapolis and quite active on ATV. The hamfest is held in the State Fair Grounds in central Indianapolis and parking was FREE and abundant. Despite the large crowd, we were able to park close enough for a comfortable walk to the hamfest building. Commercial vendors included several of the large ham stores and all remarked that sales were brisk. Although we didn't arrive until 10 and didn't set up on the table until almost 11, we sold out of all the goodies we brought and also gathered several new subscribers while having pleasant chats with ATV'ers. ATVQ will be there next year!

YORK PA ATV CONFERENCE

Plans have been agreed to between ATVQ and York Hamfest for a saturday night ATV conference. Speakers will include Murray Barlow of Science Workshop and John Beanland of Spectrum International and Henry KB9FO. Others to be annmounced. Free snacks courtesy of ATVQ will be provided and a live ATV demo will follow from the York ATVers. Full details the July ATVQ.

WINTER CES SHOW

Bill WB8ELK

January found us in Las Vegas attending the Winter Consumer Electronics Show. The Las Vegas convention center was jammed full of the latest new electronic toys to be introduced this year. It takes days in order to fully cover the entire show. Two of the most unusual items found during the event were the electronic barking dog burglar alarm and the Fishiba TV. The Fishiba is an fish aquarium made up to look like a TV complete with a VHF/UHF Tuna. I understand that 'Herring'bone interference is particularly pronounced with this unit.

There are a number of interesting new video devices on display. Unfortunately, although they are currently available in Japan, there were no immediate plans to introduce some of the most interesting items into the U.S. Guess they just brought them along to tease us! SANYO and Toshiba had a number of excellent portable color LCD TV's on display. These may show up near the end of the year. The quality of the picture is a definite step above current models of color LCD sets. Panasonic had an ultra miniature color LCD Camera which came in two units. The control box which plugs into the side of the VCR is about the size of a pack of cigarettes. The CCD and lens unit detaches from the box and is about the size of my thumb. This camera could easily mount right on your hat! The companion VCR (S VHS-C format and Hi-Fi stereo) is very lightweight and even has a color LCD monitor built into it. There were no plans to introduce these into the U.S. immediately but you might try contacting Panasonic and asking for info on the Model NV-V1 recorder and Model VZ-C1 camera.

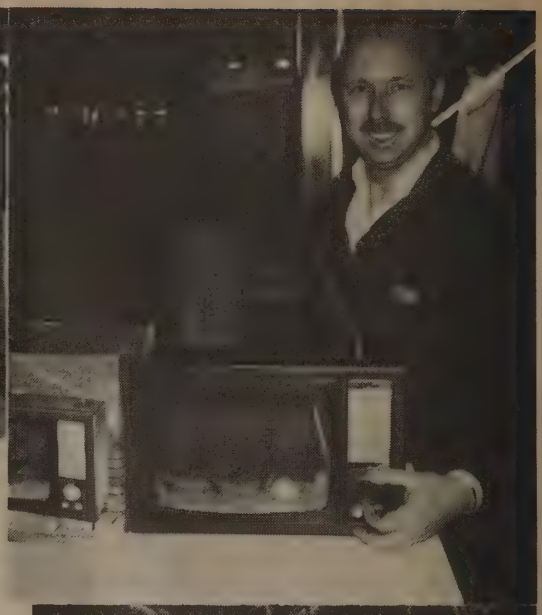
There were several items of interest to the ATV'ers that are currently available. Several small B/W CCD cameras were on display. These could be of real interest for those of you thinking of R/C aircraft ATV. The GBC Model CCD-500 weighs under a pound and draws 250mA at 12 V. DC. This solid state CCD B/W camera is very compact and will produce a usable picture under very low light levels (.02 lux). Elmo Mfg. Corp has a very similar camera (Model 8700A) and has an external sync input. Elmo also has a micro-miniature color CCD camera head with a separate control box. This is a commercial quality unit that has interesting possibilities although it's near $3000 price tag keeps it out of range of most ATV'ers.

While on the subject of compact B/W CCD cameras, AMPEREX has introduced a module that has been used by several ATV'ers. This is a module made by Phillips (Model # 56471 for EIA U.S standard - Model #56470 for CCIR European) with two small circuit boards attached to a C-mount lens holder. This module can be configured in a standard configuration with the circuit boards pointing straight back or spread out horizontally to make a very thin camera perfect for telescope mounting. This camera is ideally suited for astronomy use as the gain can be externally controlled as well as a gamma adjustment from 0.45-1.0. Coming in at 0.02 lux light sensitivity, it is so sensitive that it will provide quite watchable video with illumination from a single match. It's very sensitive in the IR spectrum and can actually see the hot tip of a soldering iron. Ernie, WB6BAP and Roy, N4ABY have both used this camera hooked up to their telescopes with excellent results. Even without a telescope you should be able to point it at a night sky and see stars clear down to 4th magnitude.

Another camera that is starting to become available in some stores is the SONY WATCHCAM. This is the same B/W camera used in the last helium balloon launch. Not only is it lightweight but it has a built-in fixed lens, auto iris and microphone. Although it is not a CCD camera, it produces a fine picture and apparently can handle extreme environments. Currently it is being sold in a complete security system and can't be bought separately. For around $700 you get two of the SONY WATCHCAMS, cables and a small monitor. The other B/W cameras mentioned above range in price from $500 - $700. There usually is a price break when more than 10 units are ordered, therefore if there is enough interest in these items contact me and we could put together some group orders.

Finally an item that impressed me with it's quality construction and operation is the STATPOWER PC-100+ power inverter. If you've ever been out in the field running mobile, covering public events and mountain-topping you'll find plenty of use for convenient 110 v. AC power. This very small unit is built into a well-shielded case and actually produces a modified sine wave which is much superior to the square wave produced by many other inverters. You can use it to power small motor-driven appliances, sensitive radio equipment and computers. I plan to run my SSTV converter mobile with my inverter. Rod, WB9KMO, mounted his inverter into a small backpack with a 5 Ah 12V battery and operated a R-7000 receiver with no detectable interference or noise. The inverter will handle 100 W loads continuously and will actually handle 200 W loads for a few minutes until the built-in over temperature circuit kicks in. This inverter will also drop out when the battery drops below 10 volts which prevents a complete discharge of the battery. An low-battery alarm will sound when the input voltage goes below 10.7 volts. I liked this inverter so much I decided to carry them in the U.S. for $139. If interested contact me at ELKTRONICS, 12536 T.R. 77, Findlay, OH 45840. 73's Bill - WB8ELK.

AMPEREX, Providence Pike, Slatersville, R.I. 02917 (401) 762-3800.(Ask for Carol Ethier)
GBC, CCTV Corp, 315 Hudson St. N.Y., N.Y. 10013 (800) 221-2240.
ELMO, 70 Hyde Park Rd. New Hyde Park, N.Y. 11040 (516) 775-3200.



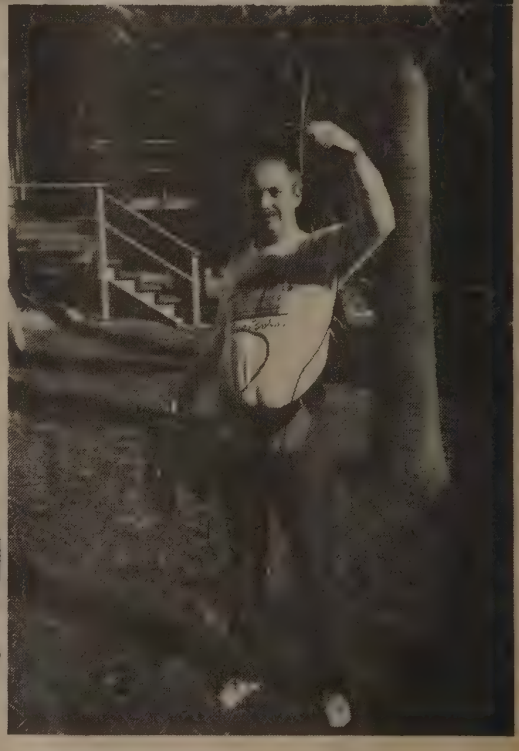
GBC

CCD-500

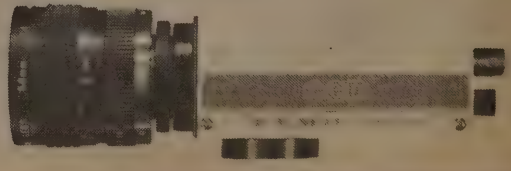
LOW LIGHT CCD CAMERA

WATCHCAM

SONY



Model 8700A



The Radio Amateur's Journal

ON THE COVER: With his retirement from the U.S. Senate, Barry Goldwater, K7UGA, finds more time available for his life-long hobby of Amateur Radio from his home QTH in Scottsdale, Arizona.

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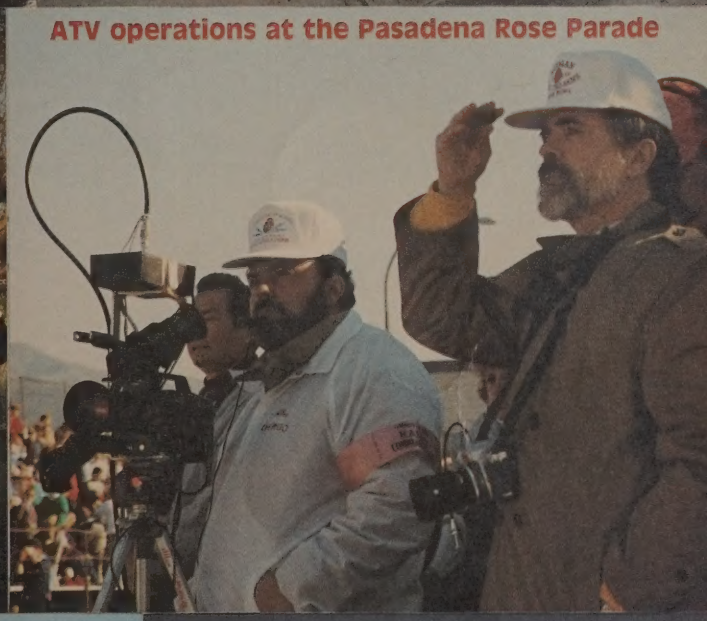

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